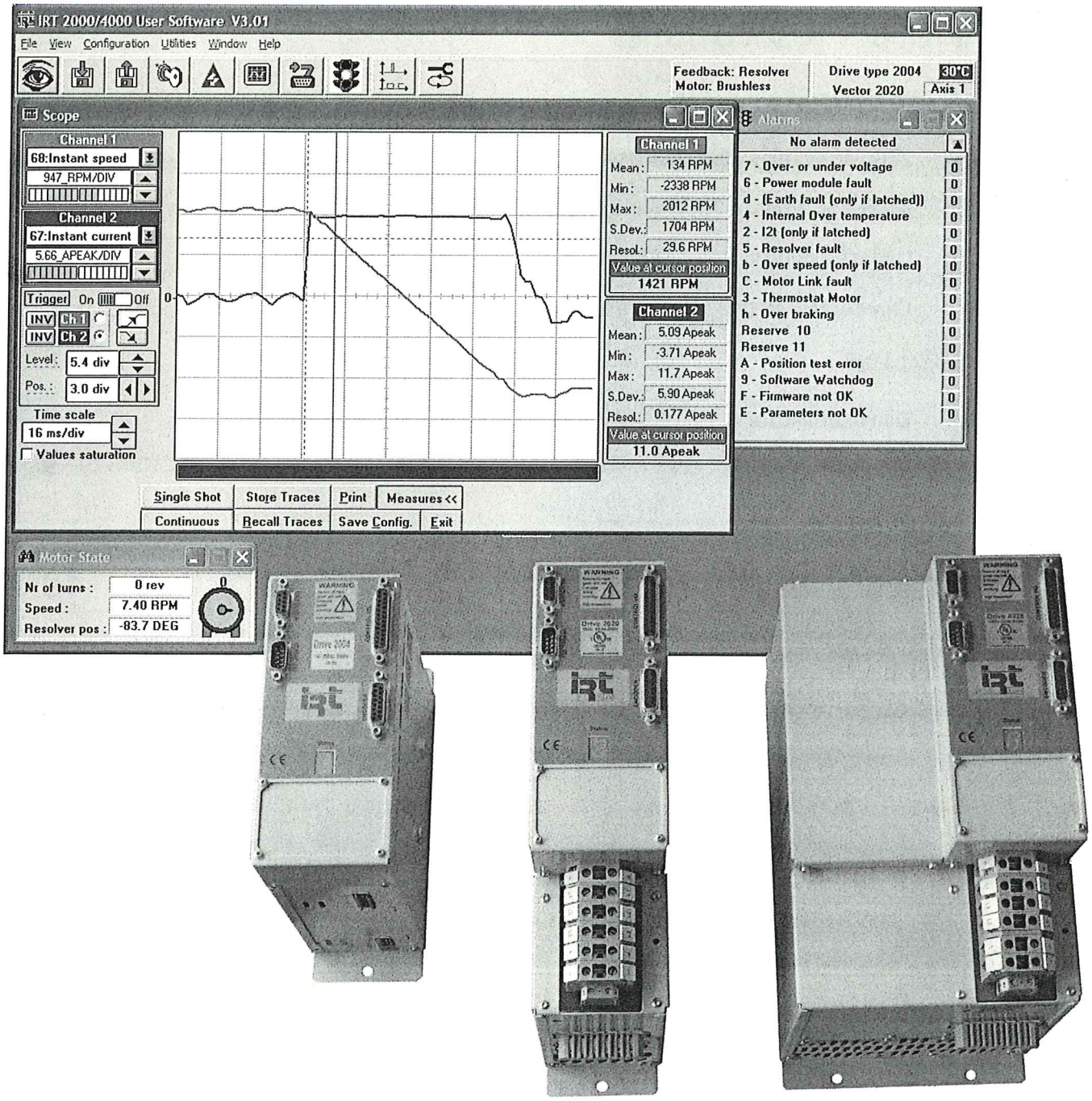
DRIVES 2000 / 4000

OPERATING MANUAL



REIS GROUP

IRT SA
Rue du Puits-Godet 16
CH-2000 Neuchâtel

Tel. +41 (0)32 729 93 60
Fax +41 (0)32 724 10 23
e-mail info@irtsa.com
http://www.irtsa.com

Your drive provider

September 2013-Rev. 4

Contents

CHAPTER B - USER UTILITIES

This section of the manual describes the use of customer utilities. The software is for PC compatible computer.

1. Windows Users

The Windows user software runs under Windows XP or later.
This software regroups all functions of the old DOS programs and advanced functions such as integrated scope (if the firmware includes this function).

1.1 2000WU : 2000 Windows User

Like many Windows applications, this software must be installed by starting the SETUP.EXE file, delivered on the installation disk (the SETUP can be executed from the file menu or from the file manager). This operation installs all libraries needed and the application icons.

Installation problems :

1) Installation message :
COMMDLG is in use. Please close all applications and re-attempt Setup.
Solution :
Choose Ignore

Using 2000WU

A double click on the  icon starts the application.

Much information are included in the help file, it can be called by the menu « Help » or by a strike of F1 KEY anywhere in the software, to obtain help on the current opened window.

1.2 Main functions of 2000 Windows user


Monitor utility to update the firmware


Parameters viewing and setting


Alarms and status view


Scope function for displaying and printing two different channels (speed, current , resolver signal , ..)


Command generator able to create different condition of command (step, impulse, periodical function, ..)

The pictures are the toolbar's icons, which start these different functions.

1.3 Update firmware with 2000WU

Connect RS232 Drive connector to the COM1 of the computer with a AT-Link cable. Verify that the axis selector is on 0.
Start the application with a double click on it's icon.

- If « *Drive Offline* » indication appears in the toolbar, the drive is not connected at the serial port COM1, then check the connection and if necessary, change the serial port by starting « *Serial link..* » in the menu « *Configuration* ». To check the connection again, start « *Drive information..* » in the « *Utilities* » menu.

- If « *COM1 already used* » message appears, the serial port COM1 is already used by a driver (maybe the mouse driver). In this case « *Serial link* » window appears automatically and it is possible to change the serial port (COM1, COM2, COM3 or COM4, the configuration is saved for a next start of the application when the « *Close* » button is clicked) .

If the drive is correctly connected, the drive type appears below *DRIVE* in the grey box at the right of the toolbar. To uploading, click on the  icon included in the toolbar. Message *WAITING FOR DRIVE RESPONSE* appears, and if the drive is correctly connected, it disappears after a few seconds. Then, a click on the *SEARCH FILE* button enable the search of the update file (i.e. IRT2007.HEX) in the system (on the hard disk or on a disk). After selection of the file a click on the *TRANSFER PROGRAM INTO DRIVE* button start the update of the firmware or a click on the *COMPARE WITH DRIVE CONTENTS* button enable the check of the FLASH memory contents.

1.4 Change parameters values with 2000WU

Similarly to the firmware update, the Drive must be ONLINE, if not, read the first part of the firmware update procedure.

Click on the  icon to start the *DRIVE PARAMETERS UTILITY* window. it is now possible to read or write parameters values.

The values are given in three different numbers; decimal value, hexadecimal value and meaning value. The decimal and the hexadecimal value are the real internal value of the drive (16 bit), and the meaning is a corrected value with a unit. Only a few parameters have a meaning value. For the others, meaning value is the same as the decimal value, without unit.

To change parameter value, use the scroll bar to move the grid on the parameter, click on the value that you want to modify, edit it and strike ENTER key.
There are three possibilities to write the value :

- Decimal (i.e. : 15567 or -23203)
- Hexadecimal (i.e. : (800)h)
- Meaning value(i.e. : 8 A or 8)

When the ENTER key is pressed, the value is sent to the drive and is read again for checking the modification.

A click on the *SAVE PARAMETERS IN DRIVE* button stores all parameters in the FLASH memory of the drive.

2. Serial Link

2.1 Dialogue protocol

This protocol is used to exchange data between computer or CNC and one axis (RS232, min 3 wires) or several axes (max. 15, RS485, 5 wires in parallel).

In RS485, all axes are listening, while answer is given only by concerned axis, other transmitters being in tristate

Orders format :

<STX><ADDRESS><COMMAND><PARAM1><PARAM2><PARAMn><ETX><BCC>

Explications :

<STX> Start of text.

<ADDRESS> Axis address.
The address is given in ASCII (address + 48)

<COMMAND> Command to execute.

<PARAM1> Address parameter or command complement.
For the address, address value + 48..

<PARAM2..n> Optional parameters.
If data, 4 digits hexadecimal value.

<ETX> End of text.

<BCC> : Block check 8 bit
<STX > XOR <ADRESS> XOR ....XOR <ETX>

Commands list:

Read parameter	"R"	address
Write parameter	"W"	address + parameter
Reset hardware	"CH"	
Store in FLASH	"ST"	

Answers format :

<STX><ADDRESS><COMMAND><PARAM1><PARAM2><PARAMn><ETX><BCC>
or
<ACK>
or
<NAK>

The answers are different depending on received command :

Write parameter :
Command : No Axis Write Address Data
Answer : ACK if order understood and executed
NAK if BCC wrong and No Axis OK

Read parameter :
Command : No Axis Read Address
Answer : No Axis Read Address Data
NAK if BCC wrong and No Axis OK

2.2 Dialogue examples

Command	Drive answer
Read parameter no 11 axis no 2 {02}{50}{82}{59}{03}{90}	Parameter no 11 = 27 = (1B)h {02}{50}{82}{59}{48}{48}{49}{66}{03}{41}
Write 127 the parameter no 28 of axis no 13 {02}{61}{87}{76}{48}{48}{55}{70}{03}{86}	ACK {06}
Store parameters in FLASH of axis no 2 {02}{50}{83}{84}{03}{52}	Nothing

CHAPTER C - DRIVE PARAMETERS

1. Parameters description

The 208 parameters of the drive are divided as follows :

Parameter address	Description	Access
0..5	Motor parameters.	Read/write Parameters
6..40	Installation parameters.	
41..45	Scope parameters.	
48..53	Command parameters.	
60..63	Internal register (for tests,..).	
64..95	Status parameters.	Read only parameters
100..179	Scope values.	
180..207	Diverse parameters	

For a few read/write parameters, a change of the value by a write order isn't directly considered. An indication is given in the « ST. » column for the read/write parameters :

- **C** : compute order must be sent to the drive to consider the change of the parameter (only for SSI)
- **S** : « Store parameters in FLASH » must be sent to the drive, for it to consider the change.
- **Nothing**: the change is directly considered.

Other abbreviations :

- **R/W** : read/write parameter.
- **R** : read only parameter.
- **O** : optional parameter (depend of firmware)
- **n.i** : parameter not included at this time.
- **RPM** : round per minute (speed units)

Important :

When VXXX→ (i.e. V2005→) is indicated in the table, the function is only avaible with specified firmware version (i.e. version 2005) or higher version.

1.1 Global list of parameters

Addr.	St.	R/W	Unit	Limits	Description
0	S	R/W	-	1..6	Pair of motor poles
1		R/W	$1/2^{16}$ turns	8000h..7FFFh	Resolver shift angle
2	S	R/W	-	0,1	Motor Thermostat n/o or n/c
3		R/W	$\frac{1}{7FFF_h} \cdot I_{MAX\_DRIVE}$	0..7FFFh	Maximum motor current
4	S	R/W	$\frac{1}{7FFF_h} \cdot I_{MAX\_DRIVE}$	0..3FFFh	Nominal motor current
5	S	R/W	ms	10..7FFFh	I^2t motor limited to maximal drive I^2t
6		R/W		1..1000	Current loop Proportional gain (Kp)
7		R/W		0..100	Current loop Integral gain (Ki)
8		R/W		0..7FFFh	Current loop Differential gain (Kd)
9		R/W	$\frac{0.1\ Electric\ degree}{1'000\ RPM}$	0..100	Phase advance
10		R/W	$\frac{1}{7FFF_h} \cdot I_{MAX\_DRIVE}$	-1,0..7FFFh	External I-limit/Loop select V2005→ negative value enable the selection speed or current loop.
11		R/W			
12		R/W	$1/8000_h$	6000h...A000h	Adj.factor sine/cosine
13	O	R/W	-	0,1	Power down back-up
14	S	R/W	-	0..3	Encoder Input configuration bit0:encoder inputs direct to output bit1:count reset on Z input

Addr.	St.	R/W	Unit	Limits	Description
15		R/W			
16		R/W			
17	S	R/W	1/revolution	1..2048	Encoder resolution 1025..2048 : Extrapolated resolution
18	S	R/W	-	0..6	Encoder marker pulse width 0: ¼ period channel A, gated B\. 1: ½ period channel A, gated B\. 2: 1 period channel A, gated B\. 4: ¼ period channel A, gated A\ (V2005- 5: ½ period channel A, gated A\ (V2005- 6: 1 period channel A, gated A\ (V2005-
19		R/W	$1/2^{16}$ turns	8000..7FFFh	Encoder marker pulse position
20		R/W		1..7FFFh	Speed loop Proportional gain
21		R/W		0..7FFFh	Speed loop Integral gain
22		R/W		0..7FFFh	Speed loop Differential gain
23	S	R/W	0.925 or 1.85 RPM	-8191..8191	Maximum speed (for 10V input) depends of encoder resolution
24	S	R/W	-	0..3	End limit switches n/o or n/c V2005→ : Bit 15 enable special functior (see detail page)
25	S	R/W	-	0..3	Direction stop
26		R/W	-	0,1	Speed or Current loop control 0: Speedloop 1: Currentloop
27		R/W	-	0,1	Digital, analogue or other command 0 : Digital 1 : Analogue 2 : Other command

Addr.	St.	R/W	Unit	Limits	Description
28		R/W	$\frac{1}{7FFF_h} \cdot V_{MAX}$	-255..255	Analogue command offset with speedloop control
			$\frac{1}{7FFF_h} \cdot I_{MAX\_DRIVE}$		Analogue command offset with currentloop control
29		R/W	55.6 RPM/s	0,1..7FFFh	Command Slope 0 : No ramp
30	S	R/W	-	0,2	Monitoring Relay Rdy/Ala/Ena 0 : Relay-Ready (Alarm inverted) 1 : Relay-Alarm 2 : Relay-Enable (V2005→)
31	n.i.	R/W	-	0,1,2	Enable hardware/serial/edge
32		R/W	ms	0..32000	Watchdog software communication (V2005→)
33	S	R/W	-	0..FFFFh	Alarm latch
	Bit		**Description**		
	0		Latch alarm 7 (over or under voltage alarm)		
	2		Latch alarm d (earth fault)		
	4		Latch alarm 2 (I^2t) (V2005→)		
	6		Latch alarm b (over speed)		
34		R/W	REV/4096	0..256	Encoder dead window (V2005→)
35		R/W	ms	0,1..136	Motor brake delay (V2005→)
36		R/W			
37		R/W			
38	O	R/W	-	0,32	SSI number total of bit
39	O	R/W		0,20	SSI number of bit per revolution

Addr.	St.	R/W	Unit	Limits	Description
40	O	R/W	Compute period (~132 us)	0..32000	IU/CU cyclic transmit period
41		R/W			Scope parameter
42		R/W			Scope parameter
43		R/W			Scope parameter
44		R/W			Scope parameter
45		R/W			Scope parameter
46		R/W			Scope options
47		R/W			
48	O	R/W	-	0..FFFFh	IU/CU command
49	O	R/W	-	0..255	Cyclic parameter address
50		R/W	0.925/4 RPM	8000..7FFFh	Digital command with Speedloop control
			$\frac{\sqrt{2}}{7FFF_h} \cdot I_{MAX\_DRIVE}$	8000..7FFFh	Digital command with Currentloop control
51		R/W	-	0..255	Status display 7 segment value 0 : Internal status, other values : bit 7 = DP, bit 6..0 = SEG A..G
52		R/W	revolution	0..FFFFh	Motor revolutions counter
53	O	R/W	-	0..FFFFh	Encoder input counter
54		R/W			Parameter for asynchronous motors
55		R/W			Parameter for asynchronous motors
56		R/W			Stepper function parameter
57		R/W			Profile & stepper function parameter
58		R/W			Profile & stepper function parameter
59		R/W			Profile & stepper function parameter
60		R/W			Internal register
61		R/W			Internal register

Addr.	St.	R/W	Unit	Limits	Description
62		R/W			Internal register
63		R/W			Internal register
64		R			Status register

Bit	Description		Drive display
0	Fault Int : Over or under voltage of DC Bus		
1	FO N	Power module fault (over I, over Temp)	
2	FO UP		
3	FO VP		
4	FO WP		
5			
6	Setup mode		
7	End-switch or direction stop active		
8	Thermostat motor		
9	V6 OK		
10	End-switch 1		
11	End-switch 2		
12	Power down		
13	External I-limit/Loop select input		
14	AC fail		
15	Enable/disable		0/1

65		R			Alarm register

Bit	Description	Drive display
0	Fault Int : Over or under voltage alarm	7
1	Power module fault	6
2		
3	Internal over temperature (>80°C)	4
4	I^2t (only if latched)	2
5	Resolver fault	5
6	Over Speed	b
7	Motor link fault	C
8	Thermostat motor	3
9	Over braking	h
10	Over speed asynchronous	u
11		
12	Position error (Profil, Stepper functions)	PA, A
13	Software watchdog	9
14	Firmware not OK	F
15	Parameters not OK	E

Addr.	St.	R/W	Unit	Limits	Description
66		R	°C		Heatsink temperature
67		R	$\frac{2\sqrt{2}}{7FFF_h} \cdot I_{MAX\_DRIVE}$	8000h..7FFFh	Instantaneous motor current
68		R	0.925 RPM	8000h..7FFFh	Instantaneous motor speed
69		R	$1/2^{16}$ turns	0..FFFFh	Resolver position within a revolution
70		R			
71		R	-	1..15	Axis address
72		R	-		Monitor Version
73		R	-		Firmware Version
74		R	-		FPGA Version
75		R			
76		R			
77		R			
78		R	-		Type of Hiperface alarm

Bit	Description
0	Type of encoder unknown
1	
2	SIN + COS out of range
3	Timeout RS485 Hiperface
4	Position error

79		R			
80		R			
81		R			
82		R			Fan switch on temperature
83		R			Control Unit ID
84		R			Commutation dead time
85		R			Options 2

Addr.	St.	R/W	Unit	Limits	Description
86		R	A_{RMS}		Maximum drive current (I_{MAX_DRIVE})
87		R	A_{RMS}		Nominal continuous drive current
88		R	ms		Maximum drive I^2t
89		R	-		Power modules
90		R	V_{RMS}		Line voltage input
91		R	-		Options 1
92		R	-		Hardware version
93		R	-		Delivery date
94		R	-		Customer
95		R	-		Serial Number
96		R	-		Firmware abilities
	Bit		**Description**		
	0		Asynchronous motor		
	1		High speed (> 6000 rmp, until 12000 rmp)		
	3		Stepper function		
	10		Software limits		
	11		Hiperface		
	13		EnDat		
	14		Setup tools		
97		R	$\frac{-10}{7FFF_h}$ V	8000..7FFFh	External analogue command 10V
98		R	$\frac{2.5}{7FFF_h}$ V	8000..7FFFh	External analogue command 2.5V
99		R	see parameter 50		Internal digital command
100	O	R			Scope values
...	O	R			Scope values
179	O	R			Scope values

Addr.	St.	R/W	Unit	Limits	Description
180		R	35 µV/bit		Resolver Sine
181		R	35 µV/bit		Resolver Cosine
182		R	$\frac{2\sqrt{2}}{7FFF_h} \cdot I_{MAX\_DRIVE}$	8000..7FFFh	Current Command
183		R			
184		R			
185		R	$\frac{2\sqrt{2}}{7FFF_h} \cdot I_{MAX\_DRIVE}$	8000..7FFFh	Phase U current
186		R	$\frac{2\sqrt{2}}{7FFF_h} \cdot I_{MAX\_DRIVE}$	8000..7FFFh	Phase V current
187		R	$\frac{2\sqrt{2}}{7FFF_h} \cdot I_{MAX\_DRIVE}$	8000..7FFFh	Phase W current
188		R			
189		R			
190		R			
191		R			
192		R			I^2t threshold
193		R			Instant I^2t

1.2 Scope parameters

Scope parameters :

5 parameters for scope settings (Address 41..45).
80 read only parameters for the measuring values (Address 100..179).

Use of scope function

When a time scale different of 0 is written, the drive starts the measurement, the parameters 100..179 are filled cyclically with samples.
When trigger condition is satisfied, the drive saves the position (trigger position parameter) and continues the measurement during the number of post-trig samples defined. At the end of the measurements, time scale parameter is set to 0 to indicate the end.

Add		Description	Comment
41		Time scale	Factor of 133 us for the sampling time.
42	HB	Parameter 1 address (channel 1)	Address of parameter 1 to measure
	LB	Parameter 1 scale	Number of shift (left shift for positive value and right shift for negative value)
43	HB	Parameter 2 address (channel 2)	Address of parameter 2 to measure
	LB	Parameter 2 scale	Number of shift (left shift for positive value and right shift for negative value
44	HB	Slope positive/negative or null	null for no trigger
	LB	Trigger value	Threshold value
45	HB	Trigger position	Address where the trig point is (100..179)
	LB	Number of Post-trig samples	0 : 100 % pretrig 80 : 0 % pretrig
46	Scope options (since firmware V2005)		bit 15 = 0 → saturation (when values overshoot with the defined scale). bit 15 = 1 → no saturation (for bit wise operations or low bits watching)
100	HB	Value 1 of parameter 1	Measured value
	LB	Value 1 of parameter 2	Measured value
..			
179	HB	Value 80 of parameter 1	Measured value
	LB	Value 80 of parameter 2	Measured value

CHAPTER D - SETTING TO WORK

1. Wiring

The wiring of the drive series 2000/4000 must be carried out according to the schematic in these instructions. Local wiring regulation must be observed.

Special attention should be paid with respect to wiring rules regarding ground, earth and neutral.

The earth wire to the drive, motor and housing must be as short as possible and connected to a common earth point.

The global wiring plan is represented in Figure 1 on page 21.

1.1 Cable lengths and cross-sections

Length of cable between drive and motor : max. 15 m.

The following table gives the minimal recommended cross-sections :

Drive type	Supply cable & Motor cable		Control signals cables	
	AWG	mm^2	AWG	mm^2
2004 2005 2006 2009 2010 4003 4005 4009	14	2	24	0.14
2020 4015 4025	12	2.5		
4050	10	5		

1.2 Global wiring plan

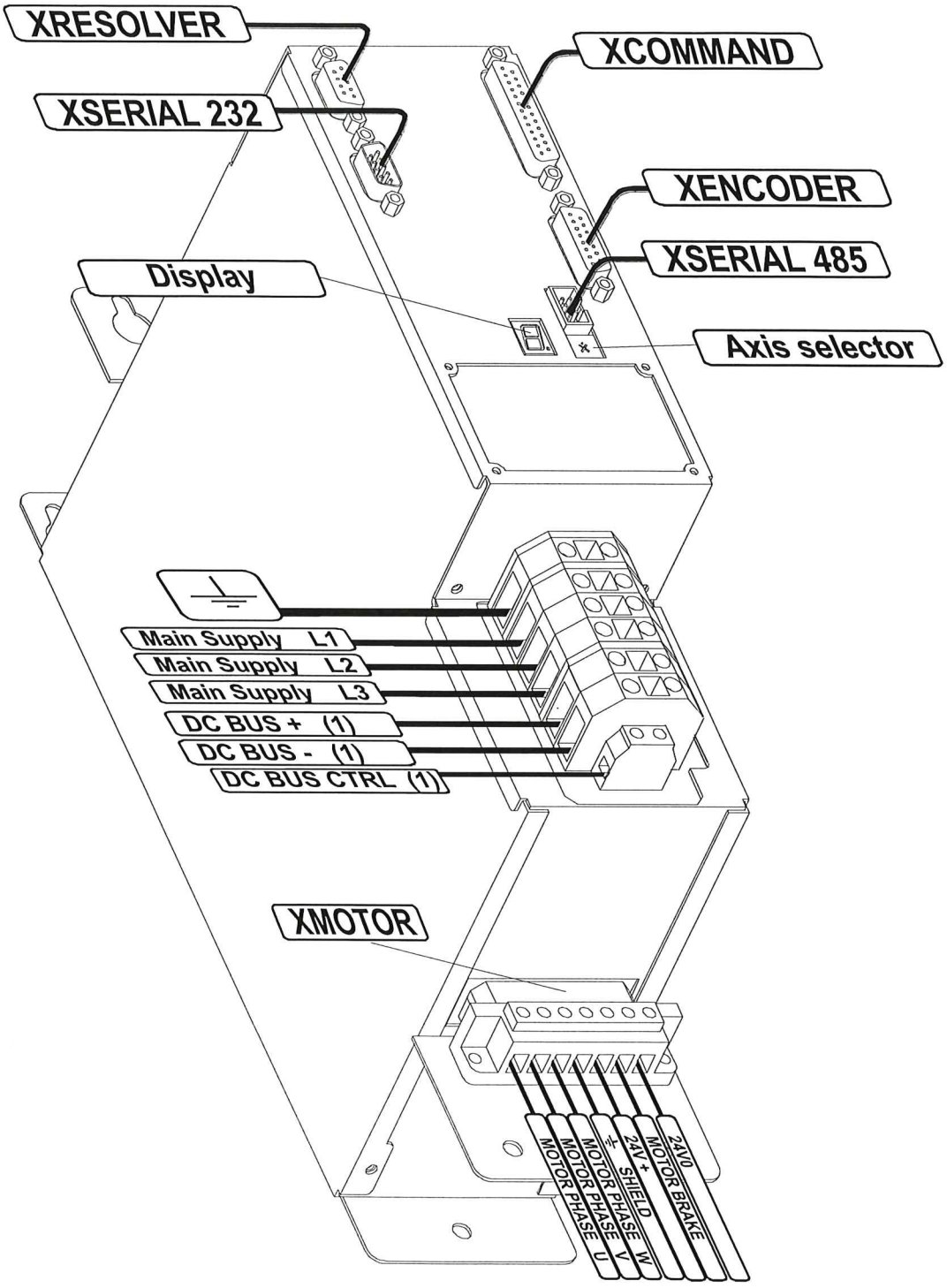


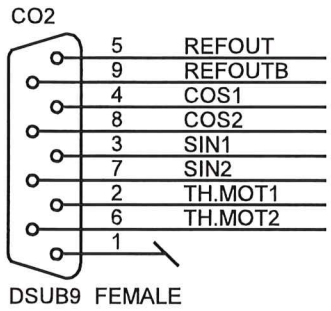
Figure 1 - Global wiring plan

(1) Note :

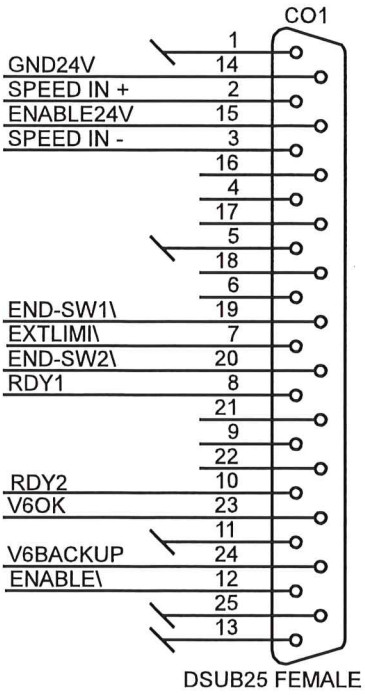
DC BUS +/- and DC BUS CTRL terminals are not present when drive is equipped with « EMC filter » option.

1.3 Control unit wiring

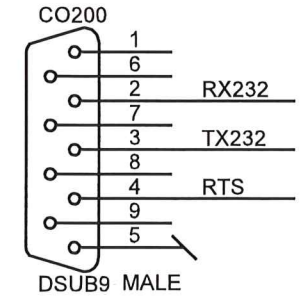
XRESOLVER



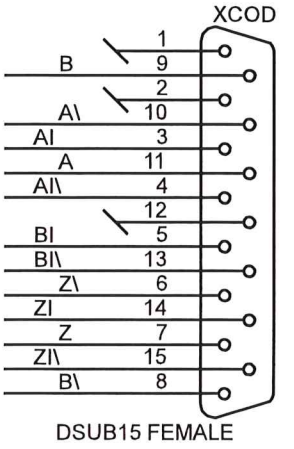
XCOMMAND



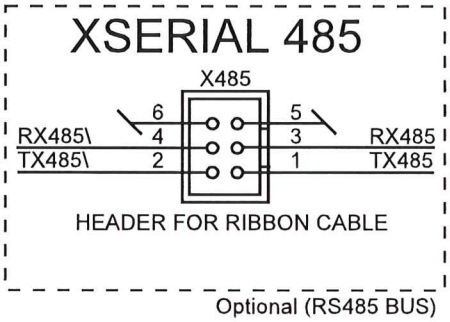
XSERIAL 232



XENCODER



XSERIAL 485



1.3.1 XRESOLVER

Correct wiring of the resolver is the **precondition** for good and reliable operation of the servo-amplifiers series 2000 & 4000. Non-compliance of the instructions operations in this manual will cause **a deterioration of the specified performances**.

A cable with the following characteristics is needed :

- 3 pairs of conductors 0,14 mm^2 twisted in pairs and shielded separately.
- 2 conductors of 0,5 mm^2 shielded separately
- an overall shield contacted with the previous shields.

The cable wiring should be done as Figure 2.

The overall shield must be connected to both the motor and the amplifier. It should be noted that the contact from the overall shield to amplifier and motor must be made by using as much contact area as possible. The use of "Pig Tail" on the overall shield should be avoided. It is recommended to follow the convention (signal / conductor colour) used in this manual.

Contacts 2 and 6 are intended for the motor thermal switch wiring. The contact should be either of type normally closed, or of type normally open.
It should have the following characteristics :

contact closed : 1 k ohm
contact opened : 10 k ohm

N.B. : Take care to the polarity with semiconductor temperature sensor.

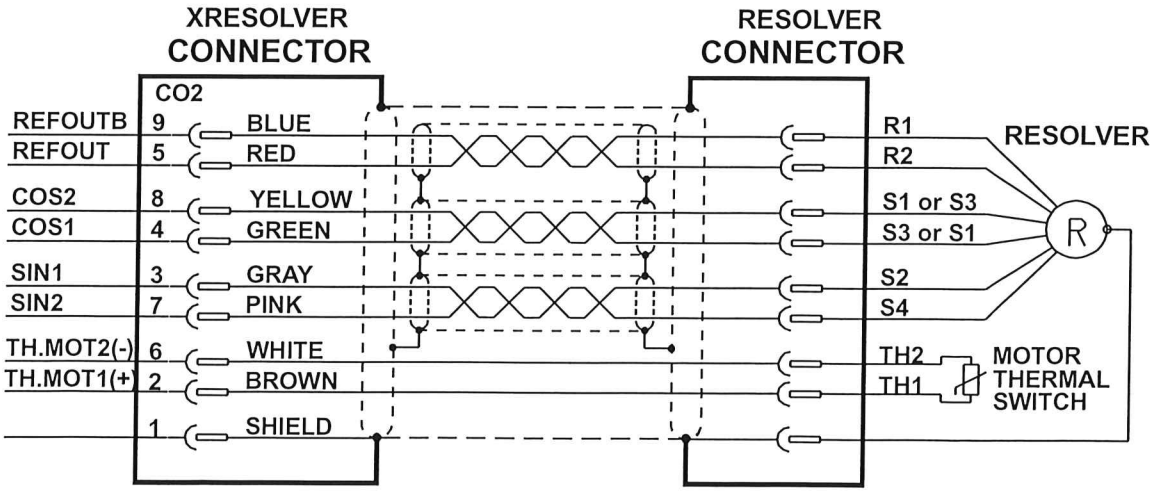


Figure 2 - Resolver and motor thermal switch wiring

1.3.2 XCOMMAND

Pin Nr.	Pin name	Function	Pin type
1,5,11,13	GND	General purpose ground for digital input, output and reference for SPEED IN.	Power ground
2	SPEED IN+	Non-inverted differential input command Max input voltage +/- 20VDC Max differential input voltage +/-10V Differential input impedance : 8kΩ	Analogue input See note (1)
3	SPEED IN-	Inverted differential input command Max input voltage +/- 10VDC Max differential input voltage +/-10V Differential input impedance : 8kΩ	Analogue input See note (1)
7	EXTLIMI\	Digital input for current limitation to the programmed value. Active low. Internal pull-up 4k7 to 5V.	Digital input
8,10	RDY1,RDY2	Potential free contact of the make contact relay. 24 VDC, 0.5 A, 10 VA	Contact output
12	ENABLE\	Passive ENABLE. Close this input to GND to active the power stage. Internal pull-up 4k7 to 5V.	Digital input
14	GND 24V	Ground of the active optocoupled ENABLE (potential free, max 50VDC to GND).	External ground
15	ENABLE 24V	Active optocoupled ENABLE. Max input voltage : 30 VDC (with respect to GND 24V) Active level : 20..30 VDC / 5kΩ (potential free, max 50VDC to GND)	Power input
19	END-SW1\	Limit switch input affecting the positive speed command. Internal pull-up 4k7 to 5V. See note (2)	Digital input
20	END-SW2\	Limit switch input affecting the negative speed command. Internal pull-up 4k7 to 5V. See note (2)	Digital input
23	V6OK	High if 6V is internal powered. Output voltage 0..6 VDC, High Z Do not load with less than 10 KΩ	Digital output
24	V6BACKUP	External 6V power supply input for the CU and optional IU boards. Supply voltage: 6..7 VDC Supply current : 500mA max + IU current.	Power input
25	GND	Ground for the external 6V power supply.	Power ground

Pins 4,6,9,16,17,18,21,22 are not used.

(1) Common mode voltage range (CMVR) +/-10V if common on SPEED IN-

(2) Close this input to GND to inhibit or to free the movement (depend of parameter 24 configuration).

The on-board relay is **normally open contact**. The rating of his contact is as follows:

24 V - 0,5 A - 10 VA

1.3.3 XENCODER

The connector XENCODER provides simulated encoder signals and allows to read signals coming from an external encoder.

Pin Nr.	Pin name	Function	Pin type
1,2 & 12	GND	Internal ground of the CU board	Power ground
3	AI	Non-inverted impulse A input	Differential input
4	AI\	Inverted impulse A input	Differential input
5	BI	Non-inverted impulse B input	Differential input
6	Z\	Inverted zero impulse output	Differential output
7	Z	Non-inverted zero impulse output	Differential output
8	B\	Inverted impulse B output	Differential output
9	B	Non-inverted impulse B output	Differential output
10	A\	Inverted impulse A output	Differential output
11	A	Non-inverted impulse A output	Differential output
13	BI\	Inverted impulse B input	Differential input
14	ZI	Non-inverted zero impulse input	Differential input
15	ZI\	Inverted zero impulse input	Differential input

Simulated incremental encoder signals provided on connector XENCODER:

The provided signals A, A / B, B / Z, Z / and GND are similar to the signals of an incremental encoder signal with differential outputs. The line driver used on-board is type 75172. The line receiver of the position controller should be type 75175.
These signals are always present and do not require any external supply.

Incremental encoder signals read on connector XENCODER:

The read signals AI, AI/ BI, BI/ ZI, ZI/ and GND are interpreted as incremental encoder signals with differential outputs. The line receiver used on-board is type 75175.

Encoder cable wiring:

The GND signal should be common to the position controller and to the servo-amplifier.

The cable connecting the position controller to the servo-amplifier should be shielded with twisted pairs for differential input and output. The shield must be connected to both the position controller and the amplifier. It should be noted that the contact from the shield to the metallic case of the amplifier plug-in connector (XENCODER) and the contact from the shield to the position controller metallic cabinet must be made by using as much contact area as possible. The use of "Pig Tail" on the shield should be avoided.

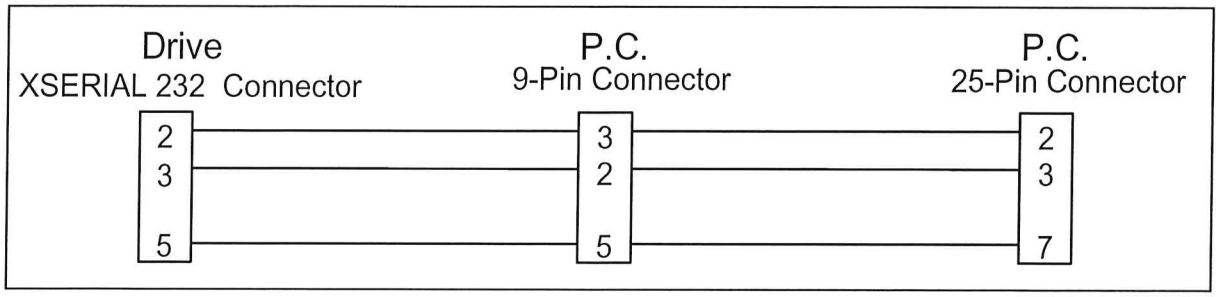
1.3.4 XSERIAL 232 and XSERIAL 485

The serial link is used to set or monitor drive parameters stored in non-volatile memory using the configuration program.
The serial links could be also used to down-load an up-dated firmware or an other firmware version.

Pin-out of the RS232 connector (XSERIAL 232)

Pin Assignment for Serial Port on the Drive			Pin Nr. for Serial Port on P.C.	
Pin Nr.	Pin name	Function	9-Pin connector	25-Pin Connector
1,6,7,8 & 9	N.C.	Not connected (potential free).		
2	RX232	Transmit Data output	3	2
3	TX232	Receive Data input	2	3
4	RTS	Request To Send output	6 & 8	6 & 5
5	GND	Common ground	5	7

The minimal wiring of the RS232 serial cable is as follows:



Pin-out of the RS485 connector (XSERIAL 485)

Pin Nr.	Pin name	Function
1	TX485	Non-inverted Transmit Data output
2	TX485\	Inverted Transmit Data output
3	RX485	Non-inverted Receive Data input
4	RX485\	Inverted Receive Data input
5 & 6	GND	Common ground

1.3.5 Axis selector

RS232 link

The axis selector must be on « 0 », the drive replies to RS232 messages sent to address Nr.1.

RS485 link

The axis selector defines the axis number of the drive, from address 1 to 15. The drive will reply to RS485 messages sent to the corresponding address (Axis selector on 5 ⇒ drive reply to messages sent to address Nr. 5).

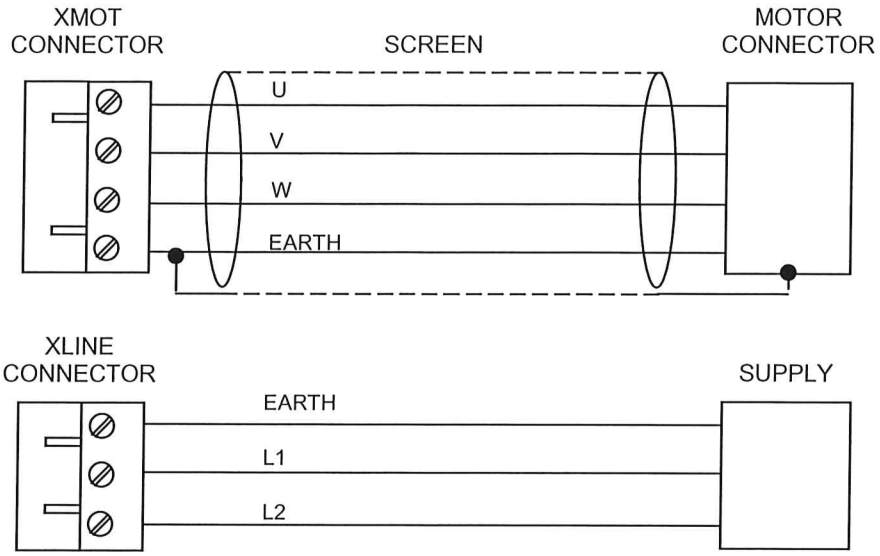
Notes :

- When the drive does not include the RS485 option (axis selector nonexistent), only the RS232 link is usable (message constituted with address Nr.1).
- See Dialogue protocol description, page 8, to know the way for the construction of messages.
- The drive must be resetted (send of Reset order or switch Power OFF/ON) to enable a change of the selector position.
- A firmware upgrade is only possible with a RS232 link.
  Exception : when drive is programmed with a monitor version 300_h (or higher), the firmware update is also possible by RS485 (the parameter 72 indicates the monitor version).

1.4 Power Connectors

1.4.1 Mini drive type 2004

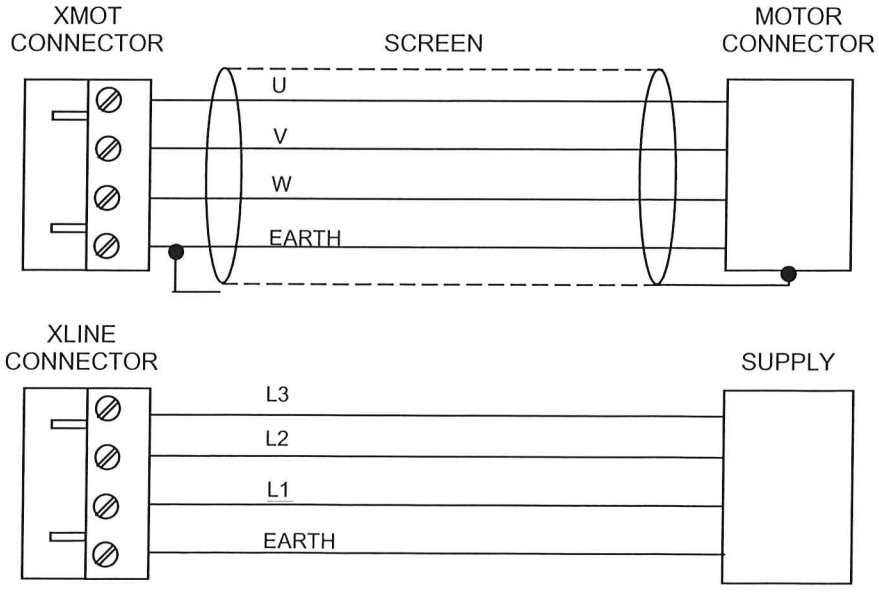
The power and motor connectors are Weidmüller, BLZ 7.50/3B and BLZ 7.50/4B (7.5 size).



Safety note : For safety use, XMOT must always be connected.

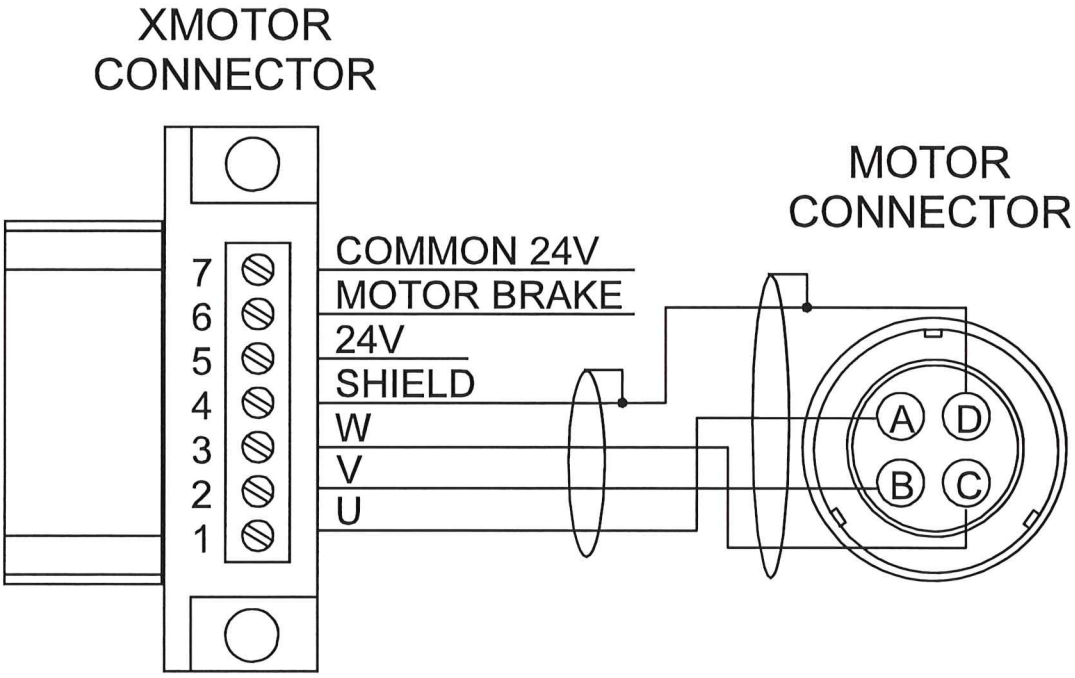
1.4.2 Mini drive types 2006 and 2009

The power and motor connectors are Weidmüller BLZ 7.50/4B (7.5 size).



Safety note : For safety use, XMOT must always be connected.

1.4.3 XMOT Connector for Small and Medium drives



Pin Nr.	Pin Name	Function	Pin Type
1	MOTOR PHASE U	Motor terminal	Power Output
2	MOTOR PHASE V	Motor terminal	Power Output
3	MOTOR PHASE W	Motor terminal	Power Output
4	SHIELD	Motor cable shield and PE	
5	24V (option)	External Power 24VDC Max input voltage : 30VDC	Power Input
6	MOTOR BRAKE (option)	Motor Brake terminal Max output current : 2.5A	Output
7	COMMON 24V (option)	Ground for the external 24VDC and for motor brake	Power Ground

Note :

See Motor brake delay parameter description, page 42, for more information about Motor brake.

1.4.4 Determining the motor phases (without drive)

> ***Important :***
> ***This operation will be done only when the three-phase motor order is unknown (motor prototype or no documentation).***

A DC supply of about 3A is necessary for this operation.

The procedure is as follows :

1. Determine arbitrarily phase **U** as one of the 3 motor phases.
2. Connect **U** to «+» and a **2nd phase** motor to «-» of the DC supply.
3. Switch supply on. The shaft will move to a stable position.
4. Mark the new shaft position with a pencil, at top center.
5. Switch supply off, disconnect the «-» from the **2nd motor phase** and reconnect the «-» to the **3rd motor phase**. Switch supply on and observe the axis rotation direction (report the direction in the table below).
6. Mark with a pencil the new shaft axis position.
7. With the help of the table below, determine the 2 unknown motor phases :

Sense of axis rotation	2nd Motor phase	3rd motor Phase
Clockwise	V	W
Anti-clockwise	W	V

When this operation is done, it is important to define the resolver shift angle parameter (P1), see section 4.1 of chapter D.

2. Display indications

The display shows the state of the drive and of the motor.


Drive in function
torque enable

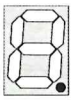

Drive in function
torque enable and zero position

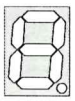

Drive in function
torque disable

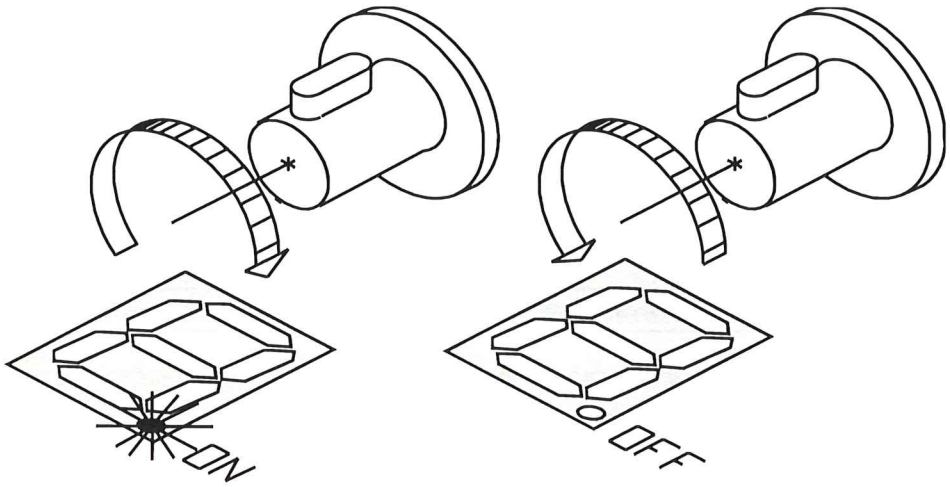

Drive in function
torque disable and zero position


End limit switch 2 activated.
The negative speed command is affected.


End limit switch 1 activated.
The positive speed command is affected.


The decimal point is « ON » when the motor turns clockwise


The decimal point is « OFF » when the motor turns anti-clockwise



If the decimal point lights up during anti-clockwise rotation, wires S1 (COS1) and S3 (COS2) of resolver connector must be inverted (see section 1.3.1 of chapter D).

2.1 Alarms

The alarm H has the most priority (following F, E, 9, C, h, 7, 6, 5, b, 4, 3, 2). If some alarms takes place simultaneously, only the one with the higher priority will be displayed.


I^2t
(only if latched)


Thermostat motor


Internal over temperature (>80°C)


Resolver fault
If >110% or <60%


Power module fault


Over or under voltage


Software watchdog


Over speed when 125% of max. motor speed is reached.
(only if latched)


Motor link fault


Parameters not OK


Firmware not OK


Hardware incompatibility
blinking


Over braking

The Parameter 33 (Alarm latch) allows you to define which alarm must be latched.

2.2 Warnings


Over current, appears during 1 sec when 120% of maximum drive current is reached (bad regulation parameters).


I^2t reached.
(if not latched)

3. Parameters settings

3.1 Motor parameters

These parameters depend on the connected motor characteristics. This information is generally indicated on rating plate of the motor or given in the motor data sheet.

PAIR OF MOTOR POLES, ADDRESS 0

This parameter must contain the number of motor poles pair. This number can be between 1 and 6 pairs.

RESOLVER SHIFT ANGLE, ADDRESS 1

This value correspond to shift angle between the resolver signal and the motor, from -½ turn to +½ turn. The zero value means a ideal combination between the resolver and the motor. See also section 4.1 of chapter D (How to set the resolver shift angle parameter, page 49)

MOTOR THERMOSTAT N/O OR N/C, ADDRESS 2

Type of thermal switch included in the motor, 1 for a normally closed contact and 0 for a normally open contact. Closed and opened contact features :

- contact closed : <= 1 kΩ
- contact opened : >= 10 kΩ

MAXIMUM MOTOR CURRENT, ADDRESS 3

The maximum motor current value is given to the drive with the following equation :

$$\frac{I_{MAX\_MOTOR} \cdot 7FFFh}{I_{MAX\_DRIVE}}$$

I_{MAX_DRIVE} AND I_{MAX_MOTOR} in A_{RMS}.
This value must be between 0 and 7FFFh, that mean between 0 and I_{MAX_DRIVE}

NOMINAL MOTOR CURRENT, ADDRESS 4

The nominal motor current value is given to the drive with the following equation :

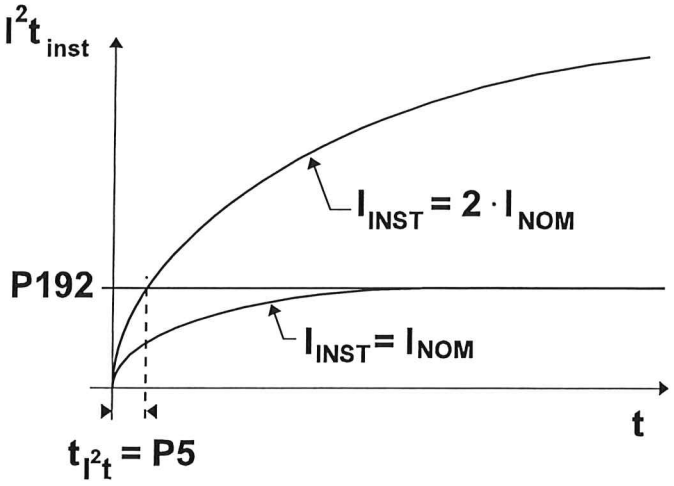
$$\frac{I_{NOMINAL\_MOTOR} \cdot 7FFFh}{I_{MAX\_DRIVE}}$$

With I_{MAX_DRIVE} AND $I_{NOMINAL\_MOTOR}$ in A_{RMS}.
This value must be between 0 and 3FFFh, that mean between 0 and $I_{NOMINAL\_DRIVE}$

I2T MOTOR, ADDRESS 5

The I^2t motor (P5) is defined as elapsed time in « ms » when I^2t value progresses from zero to I^2t threshold (P192) when drive current equals the double of nominal current (P4).

I^2t evolution for $I_{INST} = I_{NOM}$ and $I_{INST} = 2 \cdot I_{NOM}$:



Instant I2t, Address 193 :
Instant I^2t (P193) is the instantaneous value of the I^2t. In comparison of the I^2t threshold, this parameter gives an information about motor load.

I2t threshold, Address 192 :
The I^2t threshold (P192) is defined as equal to the I^2t value when continuous drive current equals nominal current.

I^2t warning (if I^2t not latched) :
When I^2t value reaches the I^2t threshold, the maximal current is limited to nominal current and 2 is displayed while I^2t value is higher than I^2t threshold.

I^2t alarm (if I^2t latched) :
The drive power stage is disabled when the I^2t value reaches the I^2t threshold and 2 is displayed.

The instant I^2t in comparison of I^2t threshold can be observed on the Scope of the user software. This method is useful to determine and to check the I^2t value and the motor load.

MAXIMUM SPEED (FOR 10V INPUT), ADDRESS 23

Maximum motor speed, this value is generally indicated on the rating plate of the motor.

Divide the RPM value by 0.925 to obtain the drive value if parameter P17 (encoder resolution) is bigger as 1024.
Divide the RPM value by 1.85 to obtain the drive value if parameter P17 (encoder resolution) is smaller as 1025.

For analogue command mode, this value fixes the speed range (max input voltage correspond to this speed).

The over speed alarm is activated (if latched) when the motor speed value is equal to or higher than 125% of the maximal speed value.

ADJ.FACTOR SINE/COSINE, ADDRESS 12

Asymmetric resolver adjustment :

factor = maximum cosine value / maximum sine value

Parameter 12 = 8000h • factor (6000h...A000h ⇒ factor = 0.75 .. 1.27)
The windows user software allows you to compute automatically this factor by a double click on the value of parameter 12 in the « Parameters values » window (just move motor position to each maximum values of sine and cosine).

3.1.1 Example of motor parameters

Example with DRIVE type 2010

MOTOR FEATURES (EXAMPLE):

Poles pairs	4	
Nominal Current	6.68	A
Nominal Power	1.320	kW
Max. Speed	3000	RPM

DRIVE TYPE 2010 FEATURES :

I_{NOM_DRIVE} = 10 A
I_{MAX_DRIVE} = 20 A

{ PAIR OF MOTOR POLES, ADDRESS 0 } ⇐ 4

{ RESOLVER SHIFT ANGLE, ADDRESS 1 } ⇐ 0

Supposition : ideal combination between the resolver and the motor.

{ MOTOR THERMOSTAT N/O OR N/C, ADDRESS 2 } ⇐ 0

Thermostat motor normally opened.

{ MAXIMUM MOTOR CURRENT, ADDRESS 3 } ⇐ 21790

With maximum motor current equal at the double of the nominal current.

I_{MAX_MOTOR} = 13.3 A

$$\frac{I_{MAX\_MOTOR} \cdot 7FFFh}{I_{MAX\_DRIVE}} = \frac{13.3 \cdot 7FFFh}{20} = 21790 = 551Eh$$

{ NOMINAL MOTOR CURRENT, ADDRESS 4 } ⇐ 10945

$$\frac{I_{NOMINAL\_MOTOR} \cdot 7FFFh}{I_{MAX\_DRIVE}} = \frac{6.68 \cdot 7FFFh}{20} = 10945 = 2AC1h$$

{ I2T MOTOR, ADDRESS 5 }

{ MAXIMUM SPEED (FOR 10V INPUT), ADDRESS 23 } ⇐ 3243

n_{MAX} / 0.925 = 3000 / 0.925 = 3243.2

3.2 Installation parameters

3.2.1 Encoder configuration

ENCODER RESOLUTION, ADDRESS 17.

Number of pulses for one revolution, between 1 and 2048 pulses per revolution.
For 1025 to 2048 pulses per revolution, it is an extrapolated resolution.

ENCODER MARKER PULSE WIDTH, ADDRESS 18.

Width of the encoder marker pulse :

0 : ¼ period of encoder output channel A, gated B\.
1 : ½ period of encoder output channel A, gated B\.
2 : 1 period of encoder output channel A, gated B\.

Firmware version 2005 or higher :

4 : ¼ period of encoder output channel A, gated A\.
5 : ½ period of encoder output channel A, gated A\.
6 : 1 period of encoder output channel A, gated A\.

ENCODER MARKER PULSE POSITION, ADDRESS 19.

Defines the shift between the marker pulse position and the position zero, between -½ and +½ turn. To shift of 1/x turn enter value 2^{16} * 1/x.

ENCODER DEAD WINDOW, ADDRESS 34.

Firmware version 2005 or higher :
Width of the dead window for encoder simulation.

0 : No dead window
1..xx : Dead window width in REV/4096.

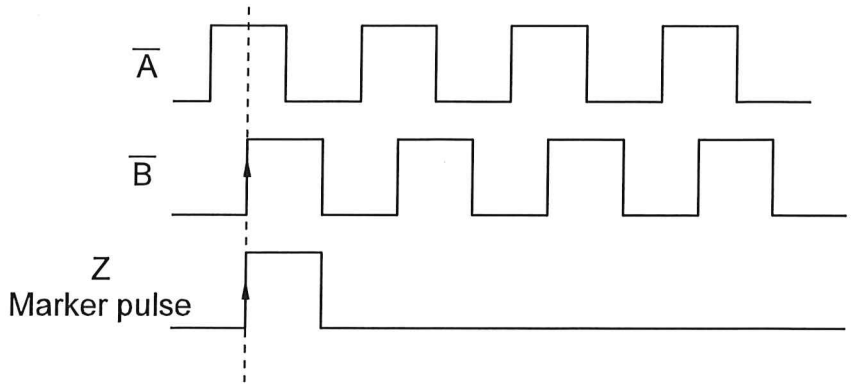
Example : The motor position oscillates from ±1/4096 revolution.
Without dead window : the encoder outputs change continually (±1 inc.).
With a dead window programmed to 3, the encoder simulation signals will be steady.
This function is useful to reduce vibrations and noises in a system, but be careful that the position precision is also reduced. The position error is not cumulative.

ENCODER OUTPUT SIGNALS EXAMPLE :

ENCODER MARKER PULSE WIDTH = 1

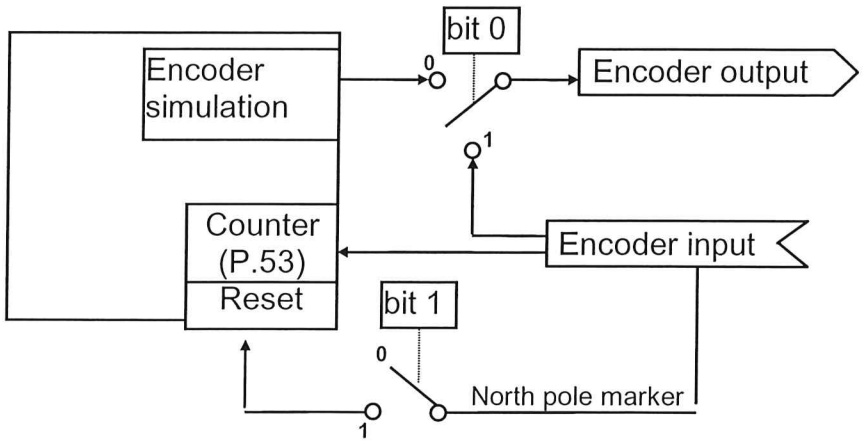
ENCODER MARKER PULSE POSITION = 0

With a positive speed (display dot off) :



ENCODER INPUT CONFIGURATION, ADDRESS 14 (OPTION).

Options for the encoder input, bit 0 and 1 must be set to change the encoder input configuration :



ENCODER INPUT COUNTER, ADDRESS 53 (OPTION).

Value of the encoder input counter. This value is incremented or decremented in accordance with the encoder input signal.

3.2.2 End-switch configuration

Limit end-switch 1 affects the positive speed command, end-switch 2 affects the negative speed command

END LIMIT SWITCHES N/O OR N/C, ADDRESS 24

End-switch 1 and 2 type, normally opened or closed contact :

	0	1
End-switch 1 (bit 0)	normally opened	normally closed
End-switch 2 (bit 1)	normally opened	normally closed

Firmware version 2005 or higher :

Special End-switch function :
Bit 15 = 0 ➔ End-switches standard function.
Bit 15 = 1 ➔ End-switch 1 input clears the integral gain of speed loop.

DIRECTION STOP, ADDRESS 25

Stop any direction by changing this value :

	0	1
bit 0	No effect	Positive speed command stopped
bit 1	No effect	Negative speed command stopped

3.2.3 SSI configuration (option)

IU/CU CYCLIC TRANSMIT PERIOD, ADDRESS 40 (OPTION).

Period for SSI data transmission.

IU/CU COMMAND, ADDRESS 48 (OPTION).

SSI internal register.

CYCLIC PARAMETER ADDRESS, ADDRESS 49 (OPTION)

SSI internal parameter.

3.2.4 General configuration

MONITORING RELAY RDY/ALA/ENA, ADDRESS 30.

0: Relay ready, the relay is activated at power up and it is deactivated when an alarm is set (Relay alarm inverted).

1: Relay alarm, the relay is activated only when an alarm is set.

Firmware version 2005 or higher :

2: Relay enable, the relay is activated when the power stage of the drive is enabled

ALARM LATCH, ADDRESS 33.

Bit 0 : Alarm 7 Over or under voltage alarm
Bit 2 : Alarm d Earth fault
Bit 4 : Alarm 2 I^2t (fimware version 2005 and higher)
Bit 6 : Alarm b Over speed

Set or clear these bits to activate or deactivate the latch of the corresponding alarm.

EXTERNAL I-LIMIT/LOOP SELECT, ADDRESS 10.

When the « EXTLIMI\ » input (XCOMMAND/PIN 7) is closed to GND, this value becomes the maximum motor current (the value of parameter 3 is disregarded).

When P.10 = 0, the limitation of maximum current by external input is disabled.

Firmware version 2005 or higher :

When P.10 = -1 :

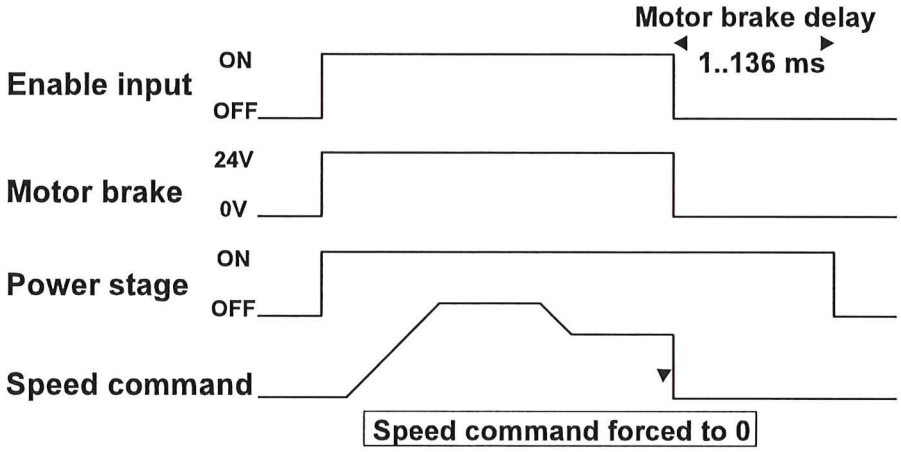
EXTLIMI\ input select the speed or current regulation loop :
EXTLIMI\ = 1 ➔ Speed loop.
EXTLIMI\ = 0 ➔ Current loop.

MOTOR BRAKE DELAY, ADDRESS 35.

Firmware version 2005 or higher :

0 : No command of motor brake

1..136 : Motor brake is opened (off) when enable input switch ON. When enable input switch OFF, the motor brake is closed (on), speed command is forced to 0 and the power stage is disabled after 1..136 ms.



WATCHDOG SOFTWARE COMMUNICATION, ADDRESS 32 .

Watchdog for the SSI link. If the drive does not receive any SSI data during the defined time (in ms), software watchdog alarm is set (if P.32 = 0: Software watchdog disabled).

Firmware version 2005 or higher :

When this value is different of 0, the watchdog is enabled with the programmed delay for all serial link communications (RS232, RS485 or SSI).

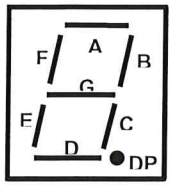
POWER DOWN BACK-UP, ADDRESS 13 (OPTION).

Defines if the drive must save the position at power down (1 for enable this function and 0 for disable).

STATUS DISPLAY 7 SEGMENT VALUE, ADDRESS 51

0: Internal status (the display indicates drive alarms or status)
Change this value to force the display of any information (drive alarms are hidden).

bit7 = DP bit3 = SEGMENT D
bit6 = SEGMENT A bit2 = SEGMENT E
bit5 = SEGMENT B bit1 = SEGMENT F
bit4 = SEGMENT C bit0 = SEGMENT G



MOTOR REVOLUTIONS COUNTER, ADDRESS 52.

This value can be read for motor position consulting and can be reset at a chosen position.

3.3 Regulation parameters

3.3.1 Configuration

SPEED OR CURRENT LOOP CONTROL, ADDRESS 26.

0 for speed loop and 1 for current loop control. When speedloop is chosen, the command is read as a speed, when currentloop the command is read as a current.

DIGITAL, ANALOGUE OR OTHER COMMAND, ADDRESS 27.

0 for digital and 1 for analogue.
Digital command :
parameter 50 (Digital command) is read to set the command value.
Analogue command :
Input voltage SPEED IN is converted to set the command value.

DIGITAL COMMAND (SPEED OR CURRENT), ADDRESS 50.

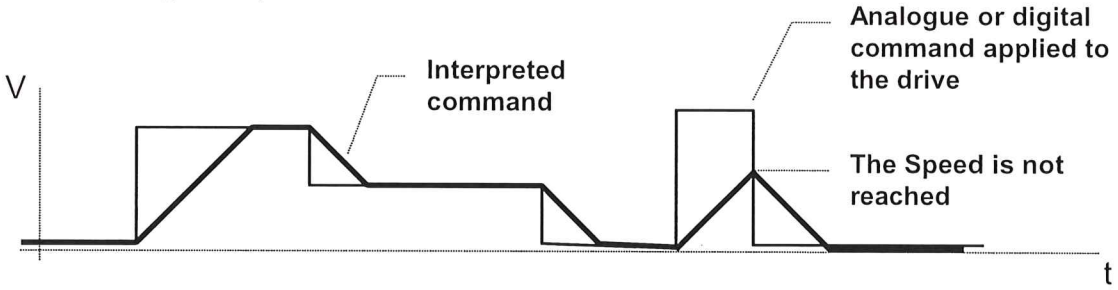
When digital command mode is set, this parameter defines the command value.

ANALOGUE COMMAND OFFSET, ADDRESS 28.

When analogue command mode is chosen, the input offset voltage can be adjusted with this parameter.

COMMAND SLOPE, ADDRESS 29.

Command ramp generator, when this parameter is null, no ramp is performed. When a value different of null is computed, the command edges are limited (for digital and for analogue command), example :



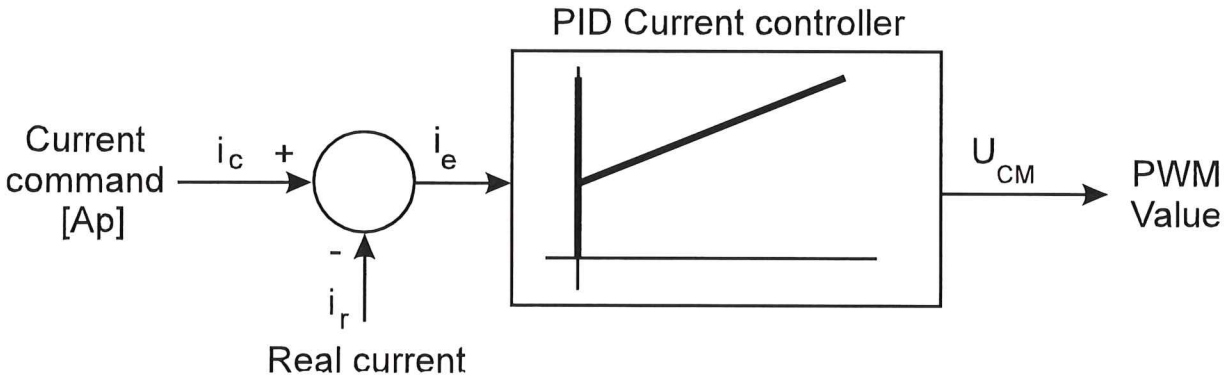
Warning :

If pulse command is applied with a command slope different of zero, it is possible that the wanted speed will be not reached (see second speed cycle of the example).

3.3.2 Current Loop

See also section 4.2 of chapter D (How to set the current loop parameters, page 51).

PID CURRENT LOOP CONTROLLER :



DIGITAL PID EQUATION :

$$U_{CM} = Kp \cdot i_{e[N]} + Ki \cdot \sum_{i=0}^{N} (i_{e[i]} \cdot \Delta T) + Kd \frac{i_{e[N]} - i_{e[N-1]}}{\Delta T}$$

$i_{e[N]}$: Last sample

ΔT : Sampling time

The drive values are obtained with the following equations :

CURRENT LOOP PROPORTIONAL GAIN (KP), ADDRESS 6.

2000 series : $$Kp = \frac{P_{CURRENT}}{\hat{I}_{MAX}} \quad [V/A]$$

4000 series : $$Kp = \frac{\sqrt{3} \cdot P_{CURRENT}}{\hat{I}_{MAX}} \quad [V/A]$$

$P_{CURRENT}$ = Parameter 6

CURRENT LOOP INTEGRAL GAIN (KI), ADDRESS 7.

2000 series : $$Ki = \frac{7500 \cdot I_{CURRENT}}{\hat{I}_{MAX}} \quad [V/As]$$

4000 series : $$Ki = \frac{7500 \cdot \sqrt{3} \cdot I_{CURRENT}}{\hat{I}_{MAX}} \quad [V/As]$$

$I_{CURRENT}$ = Parameter 7

CURRENT LOOP DIFFERENTIAL GAIN (KD), ADDRESS 8.

2000 series : $$Kd = \frac{133 \cdot 10^{-6} \cdot D_{CURRENT}}{\hat{I}_{MAX}}$$ [Vs/A]

4000 series : $$Kd = \frac{133 \cdot 10^{-6} \cdot \sqrt{3} \cdot D_{CURRENT}}{\hat{I}_{MAX}}$$ [Vs/A]

$D_{CURRENT}$ = Parameter 8

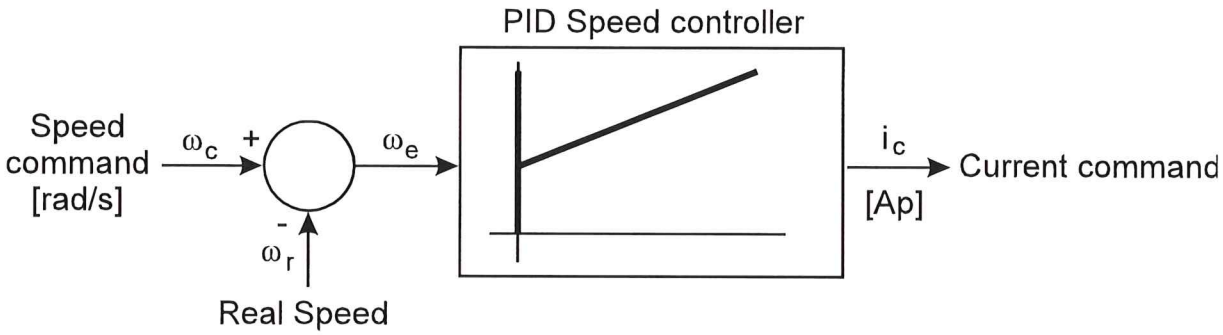
ADDRESS 9.

The PHASE ADVANCE is internally computed with a minimal value of 1.23 deg/pairs of motor poles for 1000 rpm, to compensate the delay between the acquisition of the current and the PWM output.
Only larger values than this minimal value will affect the regulation.

3.3.3 Speed Loop

See also section 4.3 of chapter D (How to set the speed loop parameters, page 53).

PID SPEED LOOP CONTROLLER :



DIGITAL PID EQUATION :

$$i_c = Kp \cdot \omega_{e[N]} + Ki \cdot \sum_{i=0}^{N} (\omega_{e[i]} \cdot \Delta T) + Kd \frac{\omega_{e[N]} - \omega_{e[N-1]}}{\Delta T}$$

$\omega_{e[N]}$: Last sample

ΔT : Sampling time

The drive values are obtained with the following equations :

SPEED LOOP PROPORTIONAL GAIN, ADDRESS 20.

$$Kp = 4{,}92 \cdot 10^{-6} \cdot \hat{I}_{MAX} \cdot P_{SPEED} \quad [\hat{A}s/rad]$$

P_{SPEED} = Parameter 20

SPEED LOOP INTEGRAL GAIN, ADDRESS 21.

$$Ki = 3{,}73 \cdot 10^{-2} \cdot \hat{I}_{MAX} \cdot I_{SPEED} \quad [\hat{A}/rad]$$

I_{SPEED} = Parameter 21

SPEED LOOP DIFFERENTIAL GAIN, ADDRESS 22.

$$Kd = 6{,}5 \cdot 10^{-10} \cdot \hat{I}_{MAX} \cdot D_{SPEED} \quad [\hat{A}/(rad \bullet s)]$$

D_{SPEED} = Parameter 22

4. How to set the parameters

To set the parameters, you need the Windows User software, refer to the section 1 of chapter B.

Resume of Windows User functions for setting the parameters :

Main window :

Regulation loop icon :

Store parameter icon :

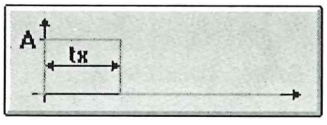
 or key F2

Scope icon :

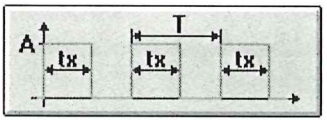
Automatic command icon :

Automatic command mode window :

Single Pulse mode button :



Single-polarity periodical mode button :



Square edge wave form button :

4.1 How to set the resolver shift angle parameter

This operation should be done when the resolver shift angle is unknown. In this case, the two following procedures are available :

4.1.1 Procedure using the motor setup tool from Windows user

❑ **A)**

Double click on the « Feedback : Resolver Motor : Brushless » button.

❑ **B)**

Click on the « Motor Setup tool » button and enable the drive.

❑ **C)**

Click on the « GO » button to find an electric zero position.

❑ **D)**

Once the position is stable, disable the drive and click on the << Store >> button to store the new resolver shift angle.

4.1.2 Procedure for manual setting

❑ **A)**

Click on the « Regulation loop » icon and click on the « M » (motor) button in the « Regulation loop » window.

❑ **B)**

Set the « Maximum motor current » to 25% of the Nominal motor current in the « Motor features » window.

❑ **C)**

Click on the « Speed command » button in the « Regulation loop » window. Then click on the « Single-polarity periodical pulse mode » button in the « Automatic command mode » window.

Enter : A = 120 rpm
tx = 200 ms
T = 200 ms

And click on the « Run » button.

❑ D)

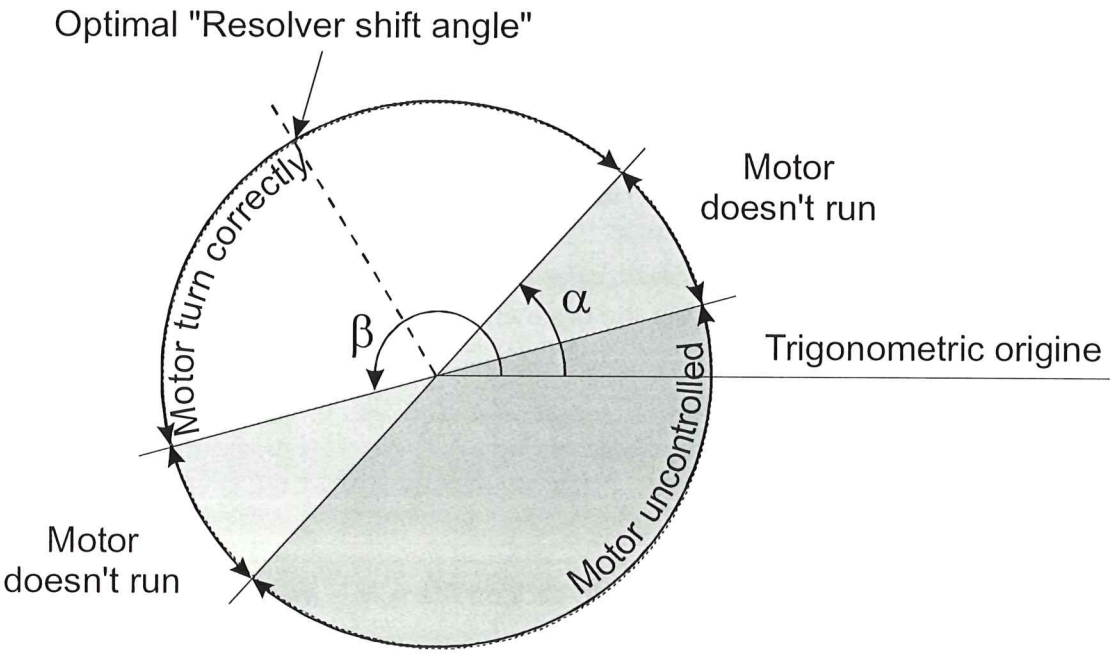
Click on the « Resolver » button in the « Regulation loop » window and Enable the drive.

❑ E)

Search the « Resolver shift angle » range where the motor is running at 120 rpm.

The optimal value of « Resolver shift angle » is in the middle of the above mentioned range.

Functioning diagram depending of the resolver shift angle setting :



The optimal value of « Resolver shift angle » is given by :

$$Optimal\ resolver\ shift\ angle = \frac{\alpha + \beta}{2}$$

❑ F)

Disable drive, store the optimal « Resolver shift angle » by striking F2.

4.2 How to set the current loop parameters

The procedure for the manual setting is as follows :

❑ **A)**

Click on the « Regulation loop » icon and select the « current loop » control.

❑ **B)**

Click on the « PID » button of the current controller and set :

- Current loop Integral gain to 0.
- Current loop Differential gain to 0.
- Phase advance to 0.
- Maximum motor current to the max. value.

❑ **C)**

Click on the « Resolver » button and set the « Resolver Shift angle » to its optimal value added or subtracted by 90°.

❑ **D)**

Click on the « Current Command » button. Then click on the single pulse mode button in the « Automatic command mode » window.

Enter : A = Max. peak value of the motor
tx = 100 ms
select the square edge wave form.

❑ **E)**

Click on the « scope function » icon and select :

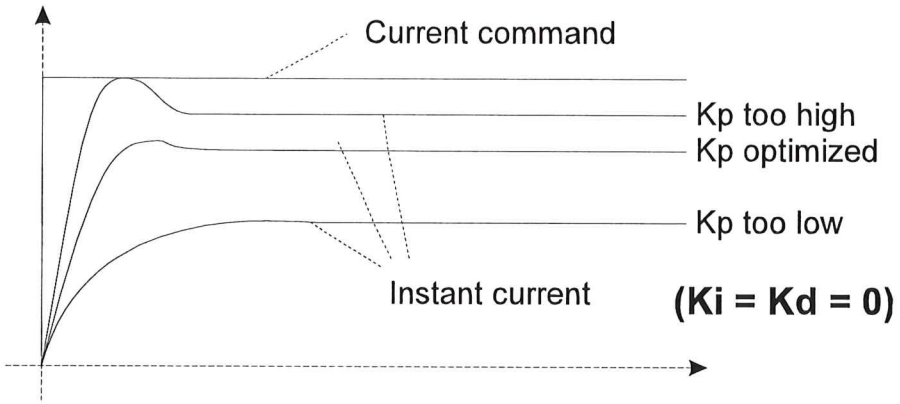
- Channel 1 : Current command (Parameter 182)
- Channel 2 : Instant current (Parameter 67)
- Suggested configuration :
  - Time scale : 1 ms/div
  - Vertical scale channel 1 and 2 : $\approx I_{DRIVE\ NOM}$ / div

❑ **F)**

Enable the drive and click on the « Run » button in the « Automatic command mode » window.

❑ G)

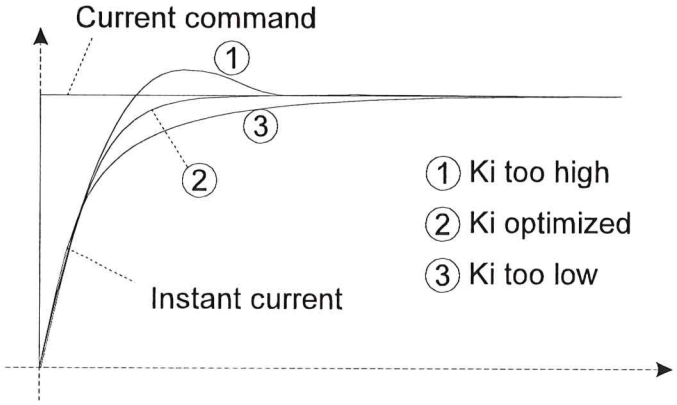
Optimize the « Current loop Proportional Gain » (Kp). The typical value of Kp is 100.



Store the optimal value of Kp by striking F2.

❑ H)

Optimize the « Current loop Integral Gain » (Ki). The typical value of Ki is 5.



Store the optimal value of Ki by striking F2.

❑ I)

The « Current loop Differential Gain » (Kd) remains in most applications at 0.

❑ J)

Set the « Resolver Shift angle » again to its optimal value and store by striking F2.

4.3 How to set the speed loop parameters

The procedure is as follows :

❑ **A)**

Click on the « Regulation loop » icon and select the « speed loop » control.

❑ **B)**

Click on the « PID » button of the Speed controller and set :
speed loop Integral gain to 0.
speed loop Differential gain to 0.
maximum speed (for 10V input) at max motor speed

❑ **C)**

Click on the « Speed command » button.
Then click on the « single pulse mode » button in the « Automatic command mode » window.
Enter : A = 1/5 of the application speed.
tx = 200 ms (for example).
select the square edge wave form.

❑ **D)**

Click on the « scope function » icon and select :

- Channel 1 : Digital command (Parameter 50)
- Channel 2 : Instant speed (Parameter 68)
- Suggested configuration :
  - Time scale : 16 ms/div (with free running motor)
  - Vertical scale channel 1 and 2 : ≈ 1/10 appl. speed / div

❑ **E)**

Enable the drive and click on the « Run » button in the « Automatic command mode » window.

❑ F)

Optimize the « Speed loop Proportional Gain ». The typical value is 5000. Two methods allow the setting of this gain.

❑ F1)

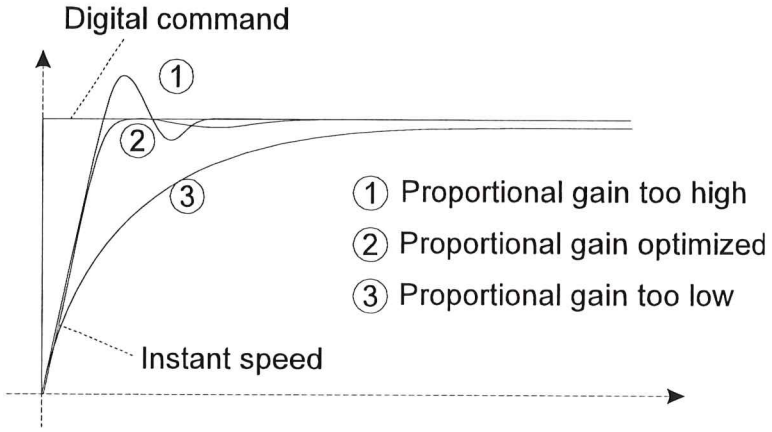
Method without the « Scope function »

Vary the « Speed loop Proportional Gain » around the typical value. The motor whistle and oscillate when the gain is too high. In this case, decrease the gain to obtain a good behaviour (stability) in the whole speed range. Store this optimal gain by striking F2.

❑ F2)

Method with the « scope function »

The respond at a single speed step command looks as follows (with free running motor) :



Store the optimal gain by striking F2.

❑ G)

Optimize the « speed loop Integral Gain ».

The typical value is 50.

Two methods allow the setting of this gain.

❑ G1)

Method without the « Scope function »

The « Speed loop Integral Gain » is too low when the axis moves « step by step » with a small speed command. The motor axis is too smooth.

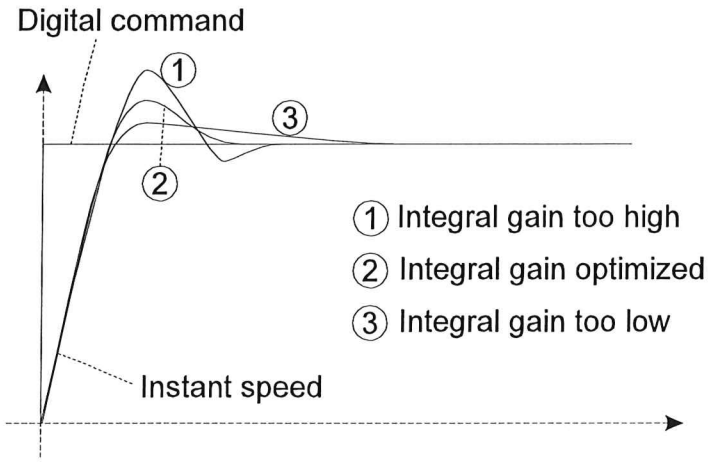
This gain is too high when the motor axis oscillates with a small speed command.

This gain is optimized when the motor axis doesn't oscillates and when the stiffness of the motor axis is sufficient to avoid its motion « step by step ».

❑ G2)

Method with the « Scope function »

The respond at a single speed step command looks as follows :

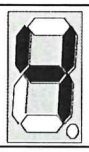


Store the optimal gain by striking F2.

❑ H)

The « speed loop Differential Gain » remains in most applications at 0.

5. Trouble shooting

Display	Trouble shooting
	I^2t reached alarm. • Check Resolver shift angle Parameter (P1). • Check I2t motor Parameter (P5). • Check drive capacity for the application.
	Motor thermostat alarm. • Motor overload. • Motor thermal switch disconnected or bad connected. • Check Motor Thermostat n/o or n/c parameter (P2).
	Drive internal over temperature alarm (> 80°C). • Drive overloaded. • Drive cooling deficient.
	Resolver alarm. • Resolver wiring or link failure. • Resolver failure. • Check resolver type see section **Erreur ! Source du renvoi introuvable.** of chapter A.
	Power module fault (over I or over temperature). • Switch off and check motor, look for short circuits between motor phases.
	Over or under voltage alarm • Check main supply input voltage L1, L2 and L3. • FBR fuse.
	Software watchdog. • Check time-out, Watchdog software communication parameter (P32). • Check serial link.
 appears during 1 second on display.	Over current alarm (125% of maximum drive current reached). • Bad regulation parameters, refer to « How to set the current loop parameters » , section 4.2 of chapter D. • Check Power supply voltage, 3 x 230V for 2000 series or 3 x 400V for 4000 series.
	Over speed alarm (125% of max. motor speed reached) • Check Maximum speed (for 10V input) parameter (P23) value.
	Motor link fault. • Motor connection failure.

Display	Trouble shooting
	Parameter not OK (wrong checksum of stored parameter) • Check parameter and store parameters.
	Firmware not OK (only after an update of the firmware) • Reload firmware.
	Over braking • Reduce the speed • Reduce the ramp or inertia
 blinking	Hardware incompatibility. • The firmware is incompatible with drive hardware.

Trouble	Possible cause
Display 0 but the motor doesn't move when a speed command is applied	• End-limit switch enable • Max. drive current too low (P3) • Motor brake engaged
The motor jump to a position and stay blocked.	• Pair of motor poles parameter (P0) misadjusted. • Motor wiring on terminal U, V, W not in the correct sequence.
Motor noisy	• Check resolver cable • Check separation between resolver and motor cable (also inside the motor). • Check earth link • Check regulation parameters.
No link with Drive (Drive Offline appears in User software while the drive is connected to the computer).	• Check **AXIS SELECTOR** position (if present) : RS232 : Position 0 RS485 : Position 1-15 The drive must be resetted to enable a change of the Axis selector position (for more information about Axis selector, see page 28). • Check link cable. • Check Serial Port number in User software.
Firmware upgrade cannot be performed.	• The firmware upgrade is possible only with RS232 link. • Check RS232 link

CHAPTER E - ASYNCHRONOUS MOTOR

Drive series 2000 and 4000 are able to control asynchronous motors. To perform this, a few conditions are required :

- Firmware version must include regulation for asynchronous motor (version 2011).
- Compatible Windows user (Version 1.20 or higher) for parameters settings.
- Asynchronous motor must have a resolver or an encoder feedback.

This chapter describes only special parameters suitable to asynchronous motor. Other parameters have the same functions defined previously in this manual.

1. Change of motor and feedback type

Important :

The change of motor and feedback type is possible only with Windows user version 1.20 or higher.

A double click in the motor/feedback box included in the toolbar of the Windows user enable a Window for the selection of motor and feedback type. This Window can be also called by the « Motor type » item of the « Configuration » menu .

If the firmware version does not include the possibility to change motor or feedback type, the selection are automatically disabled.

When the motor or the feedback type is changed, the parameter list is also updated in accordance with selected motor and feedback .

2. Special parameters for asynchronous motors

Addr.	St.	R/W	Unit	Limits	Description
9		R/W	$\frac{100}{7FFF_h}$ %	0..15%	Slip factor
11		R/W	-	0..1	Cosinus phii
54		R/W	1/revolution	0..7FFFh	Encoder input resolution
55		R/W	0.925 RPM	8000h..7FFFh	Field weakening speed
65		R			Alarm register
	Bit		Description		Drive Display
	10		Overspeed asynchronous		

SLIP FACTOR, ADDRESS 9.

Slip factor defined the ratio : $\frac{Speed_{synchronous} - Speed}{Speed_{synchronous}}$

Standard value=1..7%, usually, 4% is a good value.

COSINUS PHII, ADDRESS 11.

The cosinus phi is given from the manufacture, usually, a value between 0.8 and 0.9.

2.1 Field weakening

FIELD WEAKENING SPEED, ADDRESS 55.

If field weakening is needed, this parameter must be set to the speed value the field weakening must begin.

2.2 Asynchronous alarm

Asynchronous overspeed, set when the motor speed is higher than 133% of synchronous speed (only if field weakening is disabled).

2.3 Feedback type

Two feedback types can be used with asynchronous motor :

- Resolver
- Encoder

2.3.1 Resolver feedback

With a resolver feedback, the settings are identical as describe for brushless motors. The Resolver shift angle is ignored.

2.3.2 Encoder feedback

The encoder must be **external powered**.

The motor encoder must be wired to the encoder inputs of the XENCODER connector (see section 1.3.3 of chapter D, XENCODER wiring).

With encoder feedback, the encoder simulation is disabled, the input is directly wired on encoder output. All parameters for the configuration of encoder simulation are not used.

ENCODER INPUT RESOLUTION, ADDRESS 54.

The encoder resolution (number of pulse for one revolution) must be set in this parameter.

These instructions have been written and checked to the best of our knowledge and belief.
However, IRT will not be liable for errors and reserves the right for changes at any time without notice.

Index

DRIVE 2000/4000, OPERATING MANUAL EVOLUTION

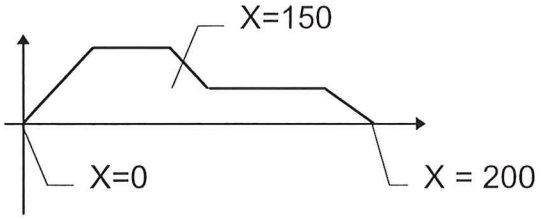
CHAPTER	SECTION	PAGE (OLD MANUAL)	PAGE	REVISION	DESCRIPTION
		1		2	New pictures
1	1	20	20	3	New drives type
				4	New layout design

Last modification : September 2013-Rev. 4

COMMAND NAME	DESCRIPTION	EXAMPLE	
IFPOSLTJMP **(V2305➔)**	At the last check position command (CHKPOS or CHKPOSREL), if the real position was less than the check position then jump to label name.	IFPOSLTJMP	LABEL1
SETOUT	Set one or several outputs (to ease the entry, « 2;5;6 » can be written « 2 5 6 »).	SETOUT	2;5;6
CLROUT	Clear one or several outputs (to ease the entry, « 3;11;13 » can be written « 3 11 13 »).	CLROUT	3;11;13
WAITINP	Wait a defined state of the inputs (to ease the entry, « IN3=0; IN5=1; IN12=0 » can be written « 3 0 5 1 12 0 »),	WAITINP	IN3=0; IN5=1; IN12=0
TESTINP	Test a defined state of the inputs for conditional jump (to ease the entry, « IN3=0; IN5=1; IN12=0 » can be written « 3 0 5 1 12 0 »)	TESTINP	IN3=0; IN5=1; IN12=0
IFTRUEJUMP	If the last input test (TESTINP command) was true, jump to label name.	IFTRUEJUMP	LABEL0
IFFALSJUMP **(V2305➔)**	If the last input test (TESTINP command) was false, jump to label name	IFFALSJUMP	LABEL2
JUMP	Jump to a label name	JUMP	LABEL1
JUMPPROF	Jump to the beginning of a profile	JUMP	1
WAITDELAY	Wait a delay time, in ms	WAITDELAY	1000
HOME	Search of origin. An input number must defined the home switch, in addition, the rotation direction (+ or -) and for synchronisation with zero pulse, a « Z » can be added	HOME	+5 or -5 +5Z or -5Z
STOPMOVE **(V2305➔)**	Stop the motor with normal deceleration. This command is passed only when motor speed = 0.	STOPMOVE	
AUTOSTART **(V2305➔)**	This command can be only used at the first line of Profile 0. It set the drive in AUTOSTART mode.	AUTOSTART	
END	end of a profile (must be the last command of each profile).	END	

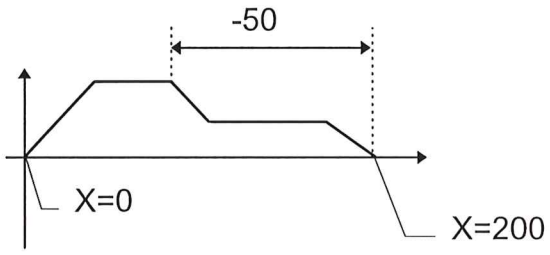
EXAMPLE FOR AN ELEMENTARY MOVEMENT :

```
SETPOS        0 REV
SETMAXSPD     1500
MOVETOPOS     200 REV
WAITPOS       150 REV
SETMAXSPD     500
WAITPOS       200 REV
```



SAME IN RELATIVE :

```
SETPOS        0 REV
SETMAXSPD     1500
MOVPOSREL     200 REV
WAITPOSREL    -50 REV
SETMAXSPD     500
WAITPOSREL    0 REV
```



AUTOSTART MODE (FIRMWARE VERSION 2305 OR HIGHER)

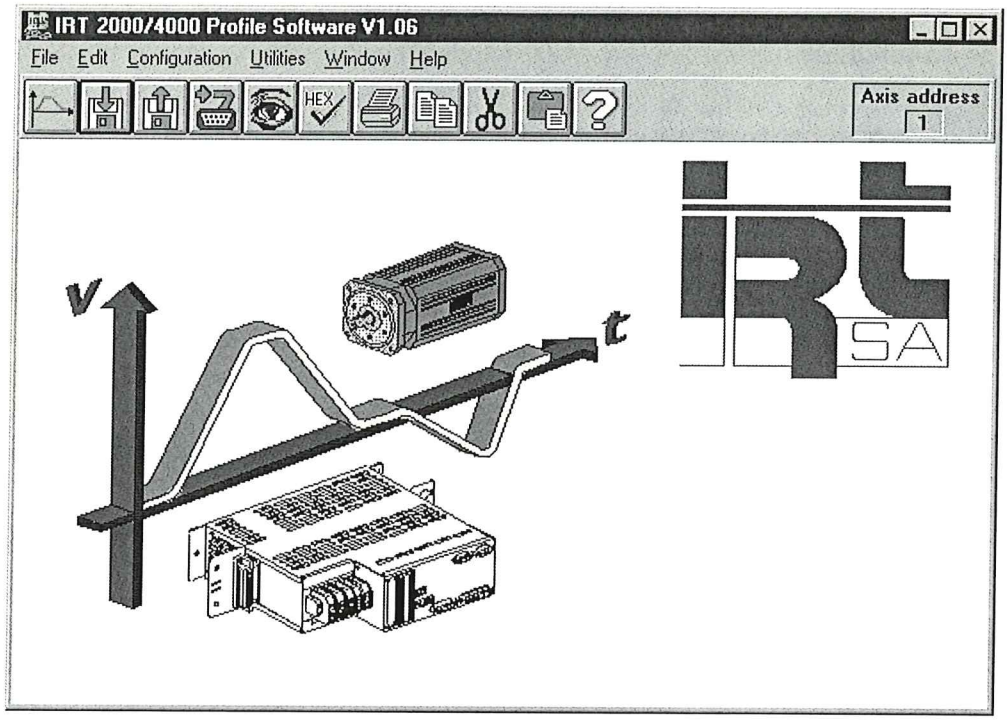
When the first command of Profile 0 is AUTOSTART, the drive is configured in autostart mode :

- At power on, the drive automatically starts the profile 0, the state of profile selection and validation inputs is not considered.
- When an END command is encountered during execution, status P-8 (Autostart end) is indicated (see page 25, section 5.1). In this case, only an INIT can restart the program (profile validation input is not considered).

The Autostart mode is useful to free inputs number 1 to 6. In this mode, this inputs can be used in program as any other input.

4.2 Windows software description

4.2.1 Main window description



Toolbar buttons :

Open a new empty program with default configuration :
1 profile
Position Unit : REV (4096 inc. ⇒ 1 REV)

Save the selected program in the current filename (command « Save as » in the file menu allows you to save the program in a different filename).

Open a program file.

Transfer utility :
a) Transfer program into Drive.
b) Compare program with drive contents
c) Import program from drive (open a new program window)

Drive Status :
a) View inputs/outputs and parameters state.
b) Scope function.

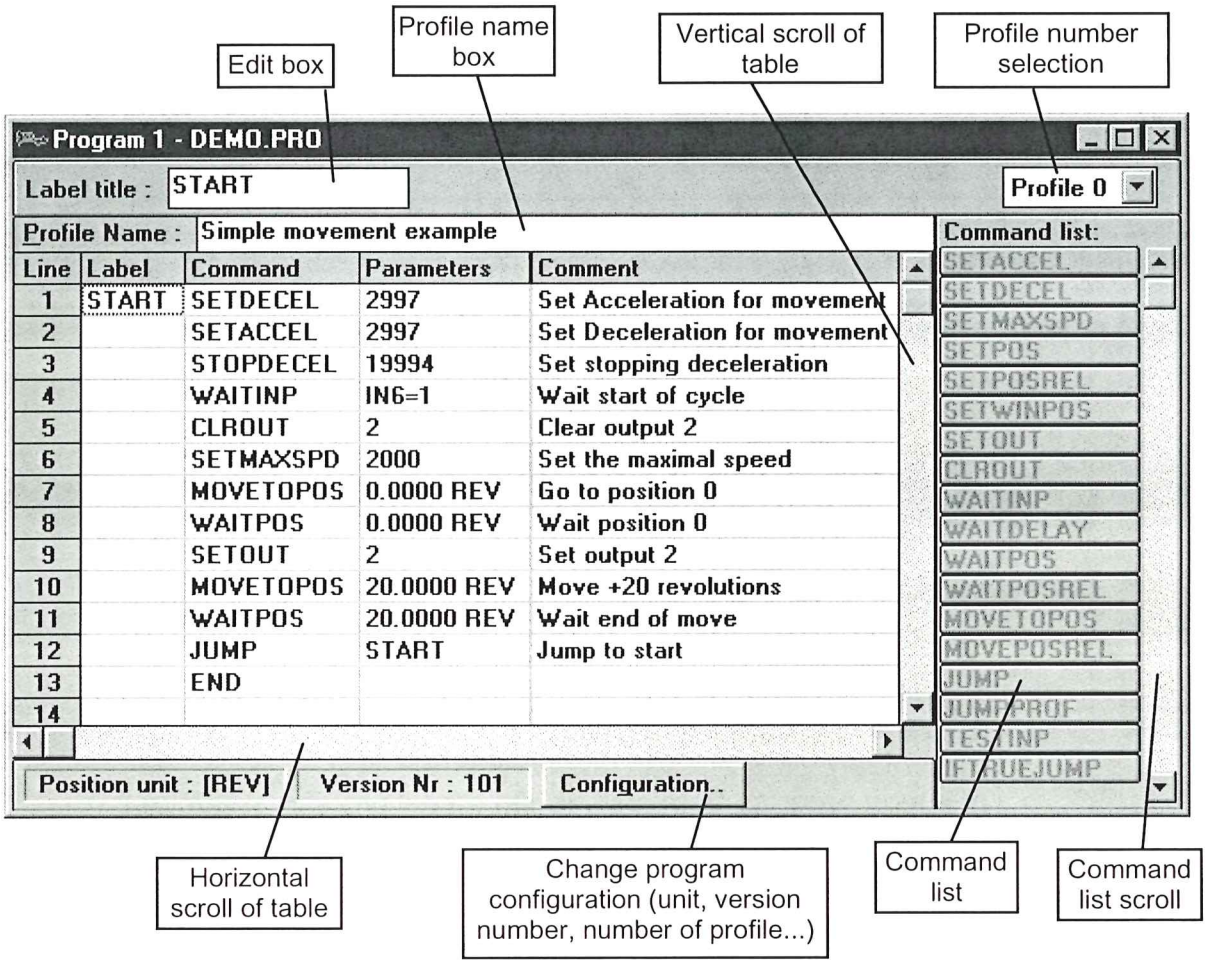
Program verification (the program is fully compiled)

Print function

Program editing functions : Copy, Cut and Paste

Current axis address, a double-click in this box opens a window for the change of the address number.

4.2.2 Program window description



a) Column label :

Line address to define a destination for a jump as example. A label name cannot be a command name and size is limited to 12 characters .

b) Column command :

Instruction name, can be selected in the command list at the right of the window or entered manually.

c) Column parameter ::

Parameter value for the specified instruction. An help box can be enabled by a click on the right button of the mouse.

d) Column comment :

This column allows the programmer to enrich the profile with annotations. It is useful when complex profiles are developed. The size of each comment line is limited to 100 characters, the view of comment column can be expanded with the horizontal scroll bar situated bellow the main table.

e) Profile name box :

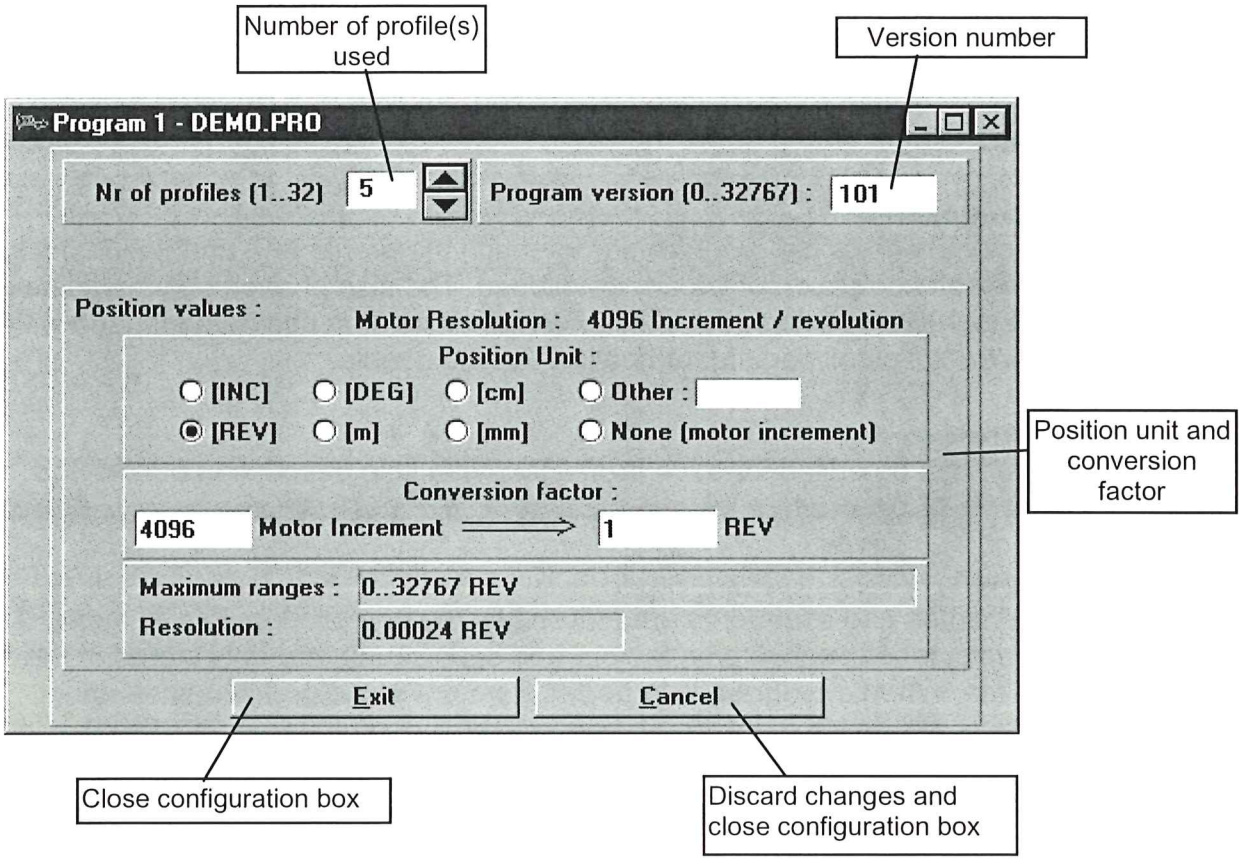
This box can be edited for each profile to give a little description of selected profile.

Important note :

Profile names and comments are ignored by the compilation. Profile name, comments, labels, conversion factors and special unit are only stored in the profile file. When a program is imported from drive, the profile names and comments will be left blank, the labels will have default names (LABEL0, LABEL1, ..), conversion factor and unit will be defined as default (4096 ➔1 and REV unit).

4.2.3 Program configuration

The configuration of a program can be edited by a click on the Configuration button of the program window. When the configuration button is pushed, the following display appears :



a) Number of profile(s) :

Defines the number of profiles used in the program. If this value is reduced the contents of unused profiles is lost

b) Version number :

This number can be used by the programmer to differentiate several program, this number is saved in drive and can be read by an import function.

c) Position unit and conversion factor

The position unit will be the string added at the end of all positions values. It can be one of the list or another that you can define.
The conversion factor is used for all position, to convert the motor increments to the correct value depending of wanted unit.
The maximum range correspond to the maximal position unit with the chosen conversion factor. And the resolution is the position value for one motor increment.

4.3 Program example

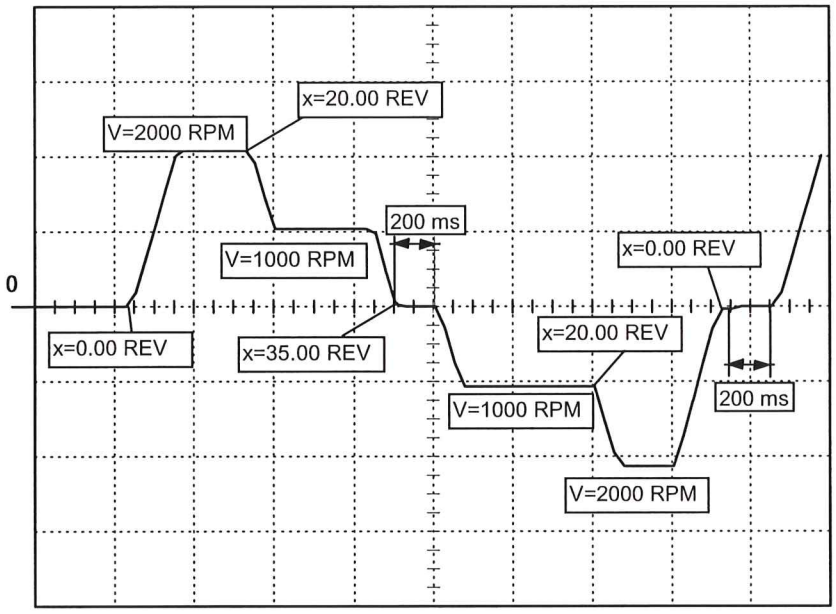
Example program :

Line	Label	Command	Parameter
1		SETDECEL	7007
2		SETACCEL	7007
3		STOPDECEL	29998
4	START	WAITINP	IN6=1
5		CLROUT	1 ;2 ;3 ;4 ;5 ;6
6		SETMAXSPD	2000
7		MOVETOPOS	0.0000 REV
8		WAITPOS	0.0000 REV
9		SETOUT	1
10		MOVETOPOS	35.0000 REV
11		WAITPOS	20.0000 REV
12		SETOUT	2
13		SETMAXSPD	1000
14		WAITPOS	0.0000 REV
15		SETOUT	3
16		WAITDELAY	200
17		SETOUT	4
18		SETMAXSPD	2000
19		MOVETOPOS	0.0000 REV
20		WAITPOS	20.0000 REV
21		SETMAXSPD	2000
22		SETOUT	5
23		WAITPOS	0.0000 REV
24		SETOUT	6
25		WAITDELAY	200
26		JUMP	START
27		END	

This example is realised with the default configuration (configuration when a new program is opened)

The input IN6 gives the start.

Speed profile V=f(t) :

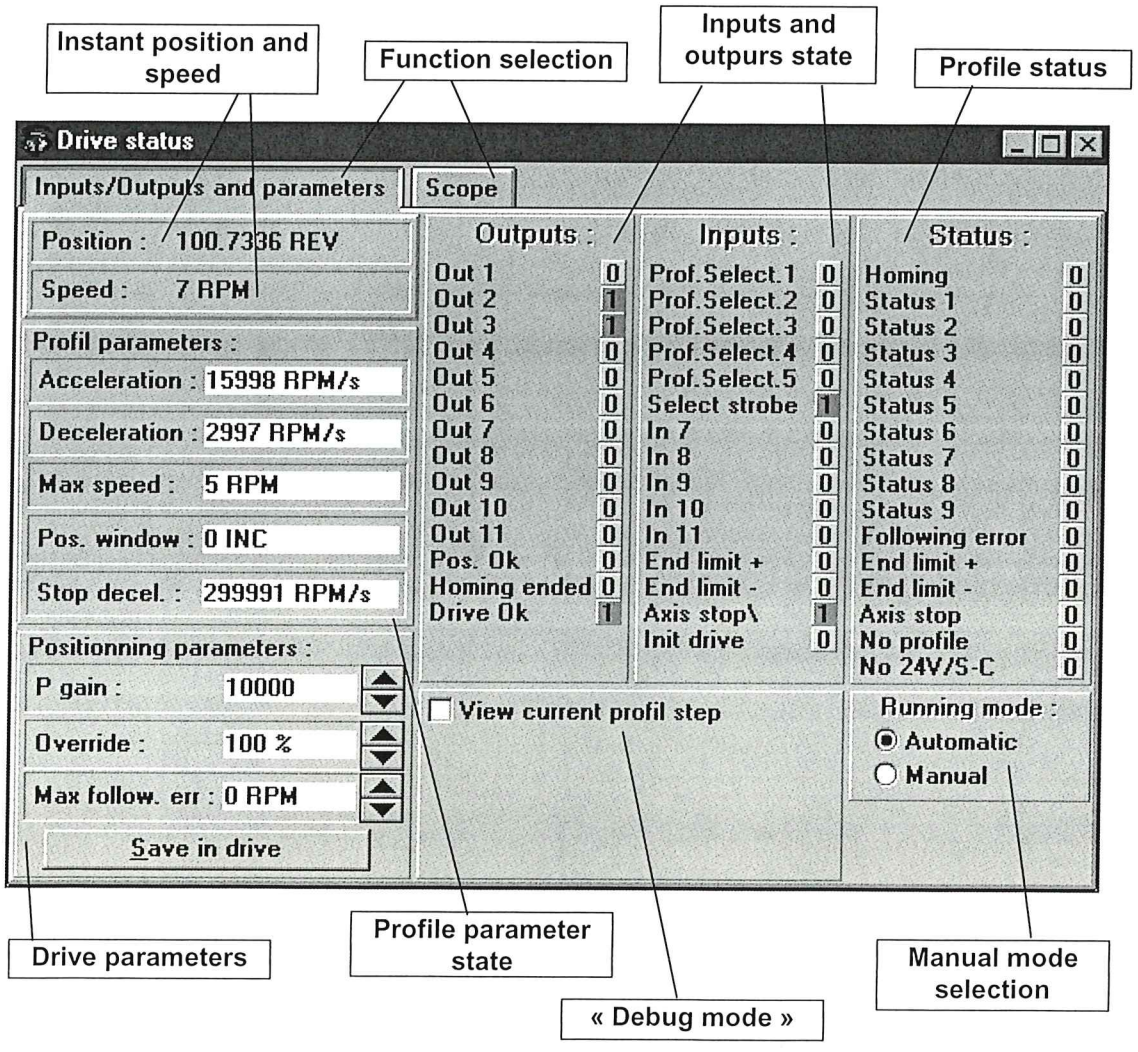


Horizontal scale : 500ms/div
Vertical scale : 948 RPM/div

4.4 Status window

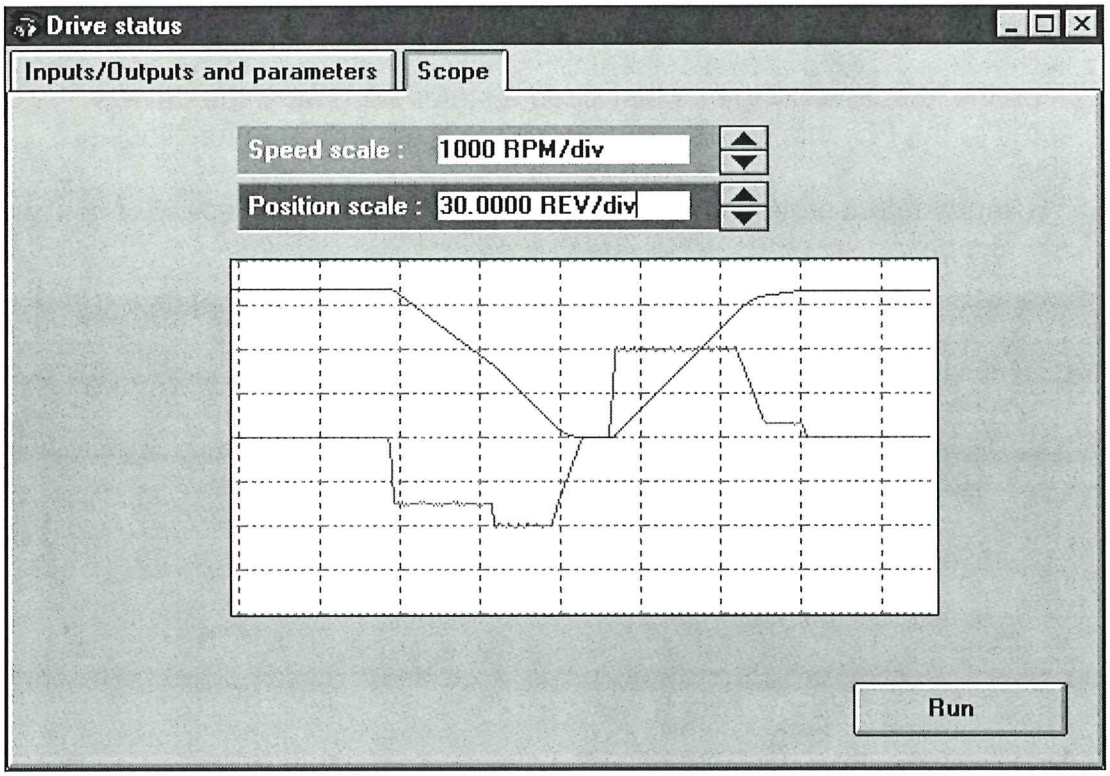
A click on the icon  of the toolbar open a status window. If the drive is connected to the PC, this window shows the profile status. Two functions are available:

- Input/output state, instantaneous position, speed, max speed...
- Scope



- The unit of the instantaneous position corresponds to the unit of the last selected program (if no program is opened, unit is defined as default in REV)
- The debug mode (« View current profile step » option) is usable only when the running program is opened (the « Import program from drive » function allows you to read the running program).

***Scope function*) :**



This function is still in development, the horizontal scale is not constant, it depend for the moment, of the used computer speed. This scope is momentarily usable to see a lowbred image of the running profile.

5. Drive parameters (particular to profile)

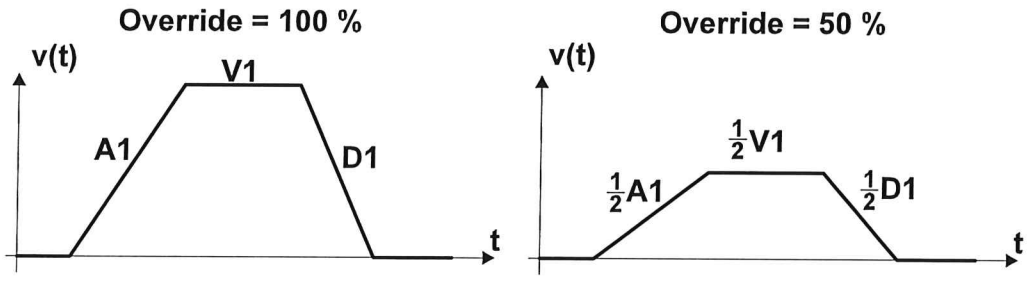
This parameters belongs to the drive parameters list, they can be modified by the standard User software or by the Profile software.

When you modifies a drive parameter value, you have to select the « Save in drive » function else the changes will be lost at power down or at initilization.

OVERRIDE, ADDRESS 57

This value affects all speed and acceleration/deceleration values. When a command set a speed or an acceleration/deceleration, the value is multiplied by the override value. This function is useful for testing slowly a profile.

Example (same profile executed with Override=100% and 50%) :



Important :

The override value is considered only at the execution of a set speed or set acceleration/deceleration command. If a profile is running in a loop which not includes a set speed or a set acceleration command, a change of the override value will never affect the profile.

POSITIONING PROPORTIONAL GAIN, ADDRESS 58

Define the positioning proportional gain, usually 10000 is a good value.

Important :

The speed loop integral gain must be different of 0 for a good position regulation.

FOLLOWING SPEED ERROR, ADDRESS 59

If this value is different of zero, the following error detection is enabled. When the difference between the speed and the command speed reach this value, the motor stops and following error (« P » - « A ») is shown on the display. The following error can be reset only by an initialization (« Init » input of power off/on).

END LIMIT SWITCHES N/O OR N/C, ADDRESS 24

Firmware version 2305 or higher :
Defines the configuration of **END-LIMIT+** and **END-LIMIT-** inputs :

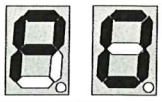
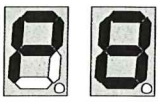
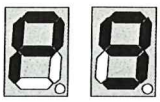
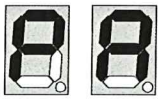
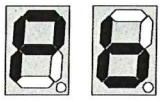
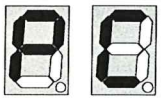
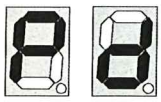
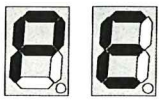
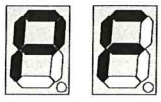
	0	1
Bit 0	Speed+ stopped when 24V applied to **END-LIMIT+** input.	Speed+ stopped when 0V applied to **END-LIMIT+** input.
Bit 1	Speed- stopped when 24V applied to **END-LIMIT-** input.	Speed- stopped when 0V applied to **END-LIMIT-** input.

Important Notes :

- The Drive inputs END-SW1\ and END-SW2\ of DSUB25 connector (XCOMMAND) are no more usable with a profile firmware.
- The RDY1 and RDY2 pins (Ready relay) of DSUB25 connector (XCOMMAND) are internally used by profile card. This relay outputs are no more usable with a profile firmware (value of drive parameter 30, relay configuration, is also ignored).

5.1 Profile status

The drive shows profile status on the 7-segment display. To indicate a profile status, the display shows « P » alternate with status number :

Display	Status description	Effect
	Homing function in progress	
	Autostart end (firmware version 2305 or higher). When a END command is encountered in Autostart mode.	• The current move is ended (move to last pointed position). • No possibility to start an other profile.
	Unknown command encountered (the current profile command is unknown from current firmware).	• Stop with defined stop deceleration. • **DRIVE OK** output disabled.
	Following error.	• Stop with defined stop deceleration. • **DRIVE OK** output disabled.
	« End-limit + » activated.	If speed > 0 : • Stop with motor maximal current.
	« End-limit - » activated	If speed < 0 : • Stop with motor maximal current.
	Axis stop (input STOP\ activated).	• Stop with defined stop deceleration.
	No profile loaded or CRC check error.	• **DRIVE OK** output disabled.
	No 24V supply or output short-circuit detected.	• **DRIVE OK** output disabled. • Stop with defined stop deceleration.

Important note :
Drive errors have higher priority than profile status, when a drive error occurs, the profile status is not more indicated by the drive display.

6. Firmware version 2305 or higher, news

From firmware version 2305, a CRC check of program is performed at drive power on. If the loaded program does not include a CRC, the profile status P-E is indicated and the program cannot be executed.

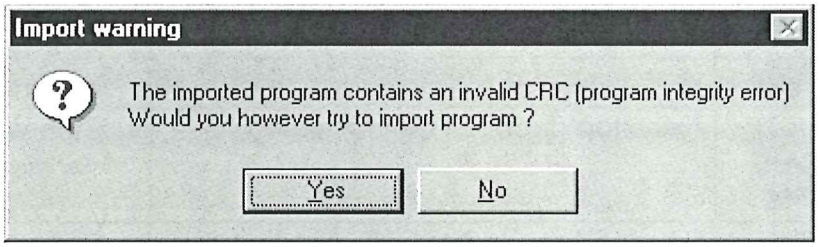
Only « Windows Profile software » version 1.07 or higher are compatible with CRC check function (compilation with CRC check).

UPDATE OF OLDER FIRMWARE VERSION :

If the drive firmware is older than version 2305 and it is updated by a firmware version 2305 or higher, the profile will generate the profile status P-E. Two possibilities to recover the profile :

- If the source file exists on the computer :
  Open the program file with a « Windows Profile software » version 1.07 or higher and transfer it into the drive.

- If the program exists only in the drive :
  Start the « Transfer utility » function in a « Windows Profile software » version 1.07 or higher and select « Import program from drive ». The following message will appear :



  Select « Yes » and when the program window is opened, transfer the imported profile back into drive.

Important note :

After the update, check the drive parameter 24 value, for firmware version 2305 or higher, this value configure the type of **END-LIMIT+** and **END-LIMIT-** inputs. It this value is setted to zero, configuration will be the same as with older firmware.

APPENDIX A - VARIABLES (PRELIMINARY)

1. Introduction

Variables are used to perform an interaction with a system. The variable values can be changed by the system through a serial link (RS232 or RS485).

The variable are grouped by blocs of eight. The variables are named with following syntax :

V<bloc number (0..3)><variable number (0..7)>

Example : V13 = Variable 3 of bloc 1

Four blocs of eight variables are usable :

Bloc0	Bloc1	Bloc2	Bloc3
V00	V10	V20	V30
V01	V11	V21	V31
V02	V12	V22	V32
V03	V13	V23	V33
V04	V14	V24	V34
V05	V15	V25	V35
V06	V16	V26	V36
V07	V17	V27	V37

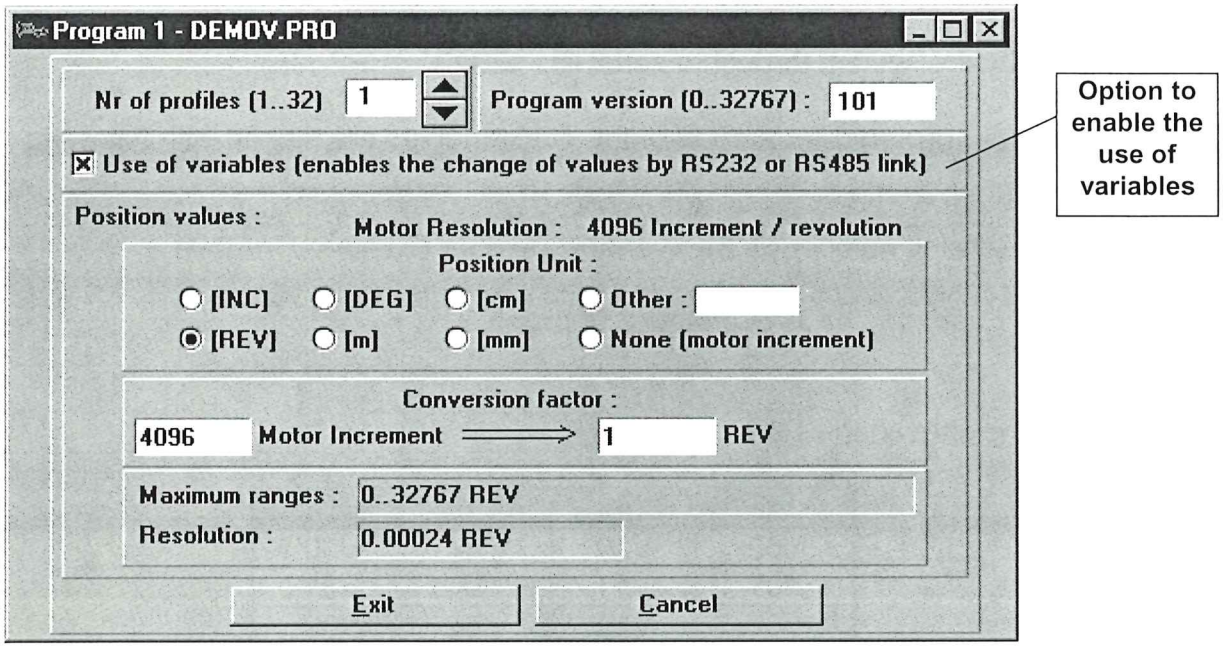
Every case correspond to one 16 bits variable, for acceleration, deceleration, speed and time values, 16 bits are needed but for position, 32 bits are needed. That's why a position variable used two variables (Example : V10 is used to define a position, V11 is also not usable because the case is used by the position V10).

Important note :

The variables use is possible only with the following version of softwares :
Firmware version : 2400 and greater.
Windows Profile version : 2.00 and greater.

1.1 Program with variables

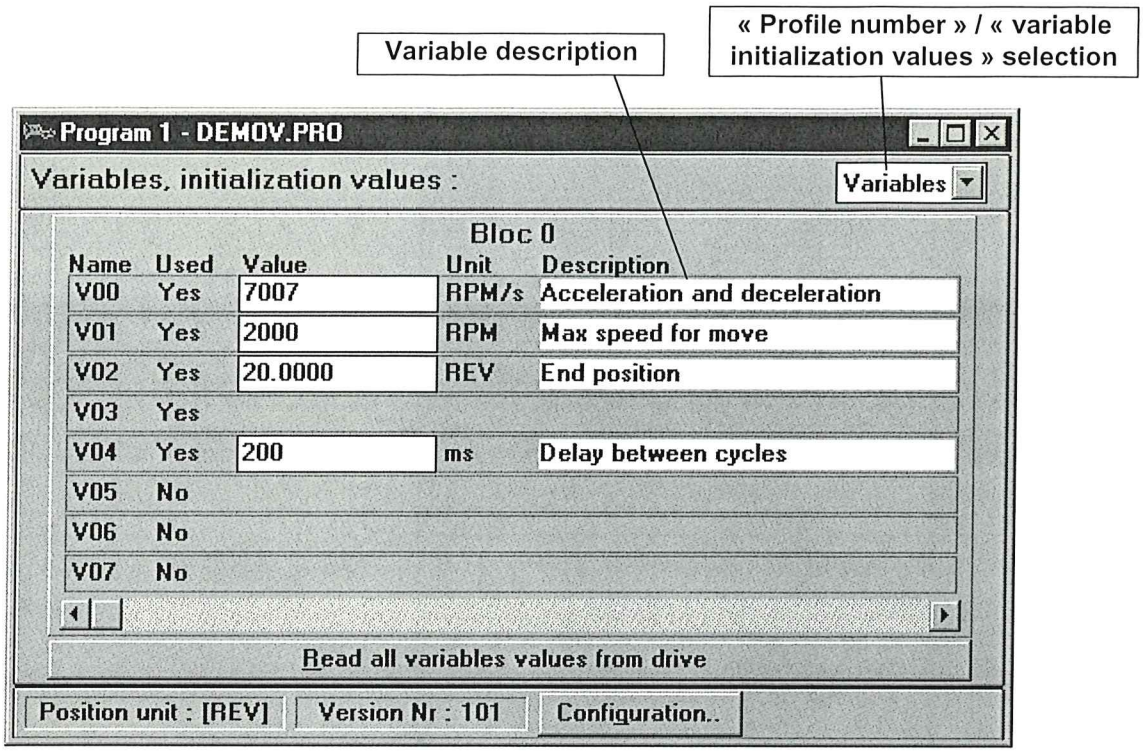
To enable the use of variable, change program configuration (only Profile software version 2.00 and greater includes variables functions):



All other configuration options are same as describe in the main Profile manual.

When the use of variable is enabled, you can simply specify a variable name in place of acceleration, deceleration, speed, time or position value. The difference with a normal value, it's the initialization, every variable must be initialized. When the program is written with the desired variables, select variables in the profile selection box at the right top of the program to show the variable initialization values.

Variables, initialization values :



Only used variables can be edited. The initialization values must be edited only after the write of program (the type of the variable must be know to display the right unit and the variable size).

The Description box can be edited to describe the variable function (optional). Like the profile names and the comments, the variable description is not saved in the drive.

Important :

When you edit a program zone that contains variables (cut or copy a program zone with variable), the used variable list can be wrong, to refresh the list, start a verification (icon 

)

1.2 Program example with variables

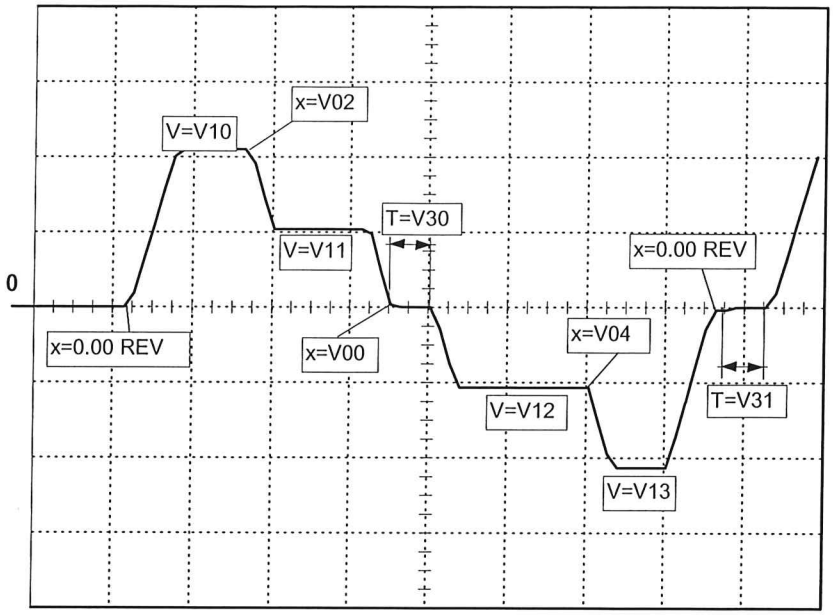
The example is the same that the example describes in the main manual but it is programmed with variables :

Line	Label	Command	Parameter
1		SETDECEL	V20
2		SETACCEL	V21
3		STOPDECEL	V22
4	START	WAITINP	IN6=1
5		CLROUT	1 ;2 ;3 ;4 ;5 ;6
6		SETMAXSPD	V10
7		MOVETOPOS	0.0000 REV
8		WAITPOS	0.0000 REV
9		SETOUT	1
10		MOVETOPOS	V00
11		WAITPOS	V02
12		SETOUT	2
13		SETMAXSPD	V11
14		WAITPOS	V02
15		SETOUT	3
16		WAITDELAY	V30
17		SETOUT	4
18		SETMAXSPD	V12
19		MOVETOPOS	0.0000 REV
20		WAITPOS	V04
21		SETMAXSPD	V13
22		SETOUT	5
23		WAITPOS	0.0000 REV
24		SETOUT	6
25		WAITDELAY	V31
26		JUMP	START
27		END	

Variable initialization values :

Bloc0		Bloc1		Bloc2		Bloc3	
V00	35.0000 REV	**V10**	2000 RPM	**V20**	8000 RPM/s	**V30**	200 ms
V01		**V11**	1000 RPM	**V21**	8000 RPM/s	**V31**	200 ms
V02	20.0000 REV	**V12**	1000 RPM	**V22**	50000 RPM/s	**V32**	
V03		**V13**	2000 RPM	**V23**		**V33**	
V04	20.0000REV	**V14**		**V24**		**V34**	
V05		**V15**		**V25**		**V35**	
V06		**V16**		**V26**		**V36**	
V07		**V17**		**V27**		**V37**	

Speed profile V=f(t) :



Horizontal scale : 500ms/div
Vertical scale : 948 RPM/div

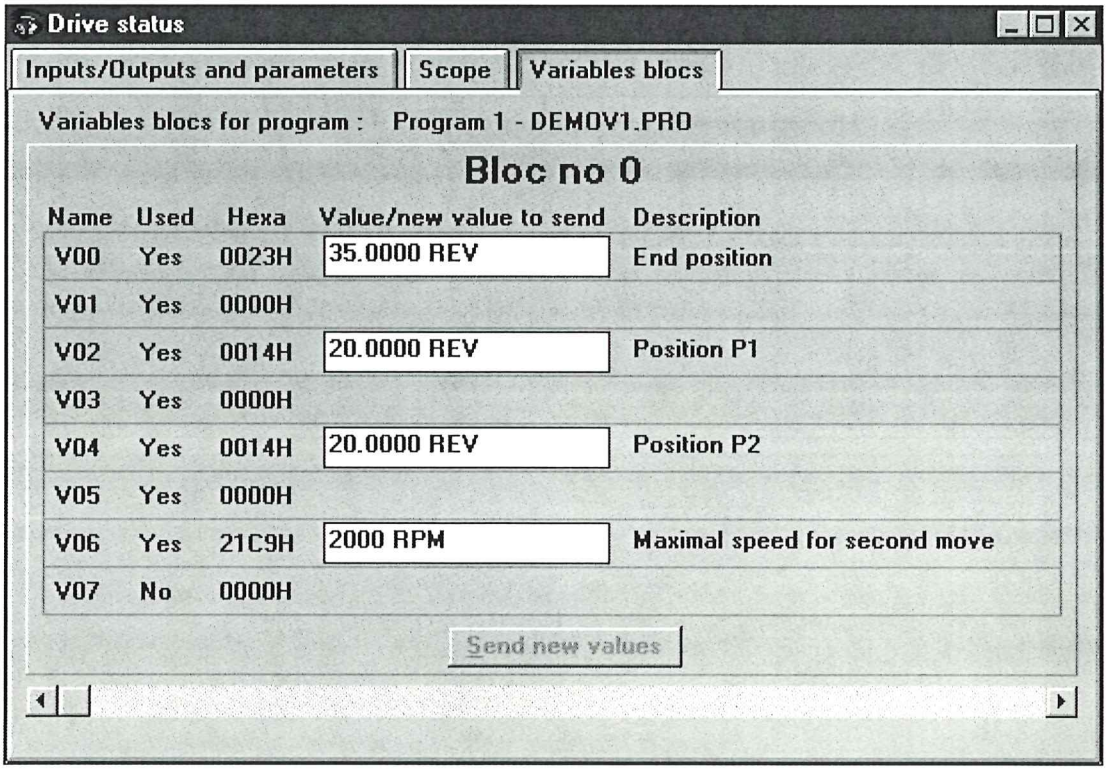
2. Variables, viewing and editing values

The variable blocs can be displayed and edited during program execution with the drive status function (icon ) of the windows software.

The variables values can be changed and sent to the drive during execution.

Important :

To display the correct unit of the variables, the executed program must be selected before the start of « Drive status » (« Import program from drive » button in transfer utility function get the program from the drive).



If the drive is connected to the computer by a RS485 link, you can easily view the variables values of each axis. You just have to change the axis address (a double click on the « Axis address » box open a window for selecting the axis address).

Every system can access to the variable blocs with the protocol defined in section 2.2.

2.1 Profile Blocs

Eight blocs (only four if variables are not used) are used for the dialogue between the drive and the command system :

Bloc Addr.	Access	Nr.	Description
32	Read/ write	0	0:Automatic/1:Manual mode
		1	Positionning window
		2	Acceleration
		3	Deceleration
		4	Stop Deceleration
		5	Max Speed
		6	
		7	
33	Read/ write	0	Manual : Move relative HW
		1	Manual : Move relative LW
		2	
		3	
		4	
		5	
		6	
		7	
34	Read only	0	Status
		1	Input
		2	Output
		3	Speed command
		4	Instantaneous speed
		5	Profile, address pointer
		6	Instantaneous position HW
		7	Instantaneous position LW
35	Read only	0	
		1	
		2	
		3	
		4	
		5	
		6	End position HW
		7	End position LW
36	R/W	0..7	Variable bloc 0, values V00..V07
37	R/W	0..7	Variable bloc 1, values V10..V17
38	R/W	0..7	Variable bloc 2, values V20..V27
39	R/W	0..7	Variable bloc 3, values V30..V37

Note :

When manual mode is set ({ bloc 32, 0 } = 1) the motor stop to the last pointed position, the profile execution is suspended. In manual mode, a manual move can be set by writing a relative position in cases 0 and 1 of bloc 33. The manual mode is used by the Profile software, in status window to ease the search of motor position. When automatic mode is set again ({ bloc 32, 0 } = 0), profile execution is resumed.

2.2 Values descriptions

The drive values are not directly usable, to obtain values with same units as used in « Windows Profile Software », following factors are given :

Value with unit → Drive Value

Speed values :

X RPM → $X \cdot \frac{4}{0.925} = X \cdot \frac{1}{0.23125}$

3'000 RPM → 12973

Acceleration and deceleration values

X RPM/s → $X \cdot \frac{1}{0.925 * 15} = X \cdot \frac{1}{13.875}$

10'000 RPM/s → 721

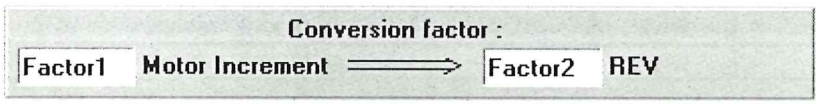
Time values (for delays)

X ms → $X \cdot \frac{1}{2} = X \cdot 0.5$

500 ms → 250

Position values

Each positions are composed of two 16 bits words, number of revolution and position within a revolution. To compute this numbers, the position is firstly converted in increments with the factor defined by the user :



$$\text{Number of increments} = \text{Position} \cdot \frac{\text{Factor1}}{\text{Factor2}}$$

Then, the two words values are defined as follows :

$$1^{st}\text{ word} = \langle \text{Number of revolution} \rangle = \text{INT}\left(\frac{\langle \text{Number of increments} \rangle}{4096}\right)$$

Limits : -16384..16384

$$2^{nd}\text{ word} = \langle \text{Position within a revolution} \rangle = (\langle \text{Nr.of inc.} \rangle \text{ MOD } 4096) \cdot 16$$

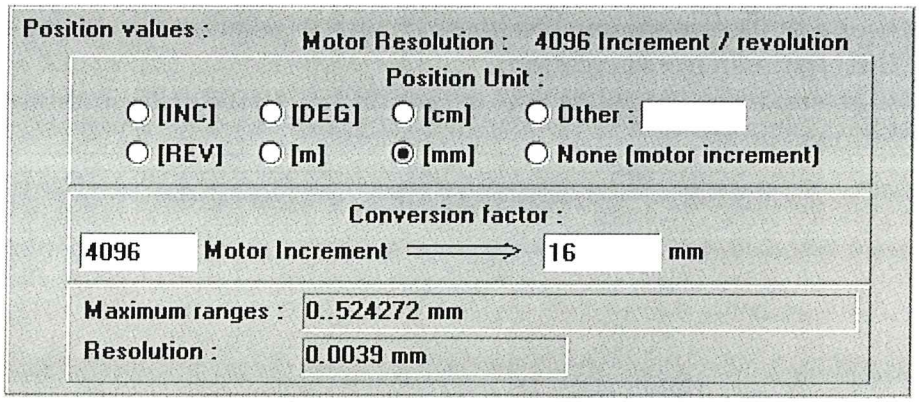
Limits : 0..65535

Notes:

- « INT(*number*) » function return the first integer less than or equal to *number*.
  Examples : « INT(4.2) = 4 », « INT(5.8) = 5 », « INT(-7.2) = -8) ».
- « *number1* MOD *number2* » operation return the remainder of the integer division *number1*/*number2*.
  Examples : « 5000 MOD 4096 = 904 », « 9096 MOD 4096 = 904 ».

Position values conversion, examples

a) V00 = 110 mm, with following configuration :

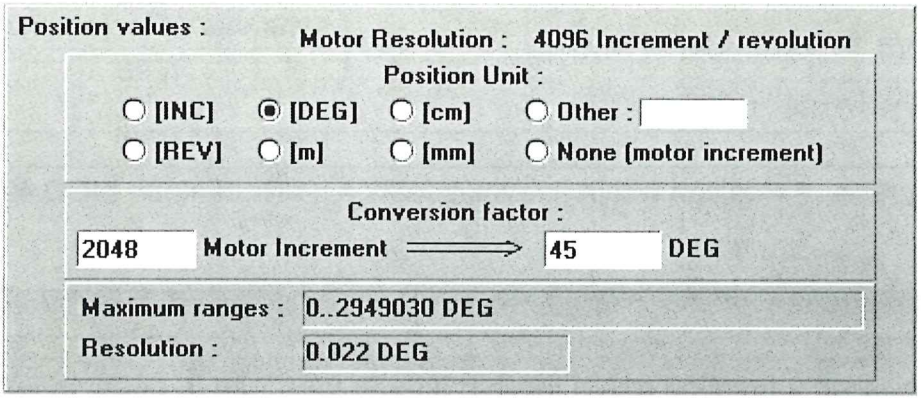


Number of increments : 110 mm ➔ $110 \cdot \frac{4096}{16} = 28160$ INC

Number of revolutions : $V00 = \text{INT}\left(\frac{28160}{4096}\right) = \text{INT}(6.875) = 6 = 0006_H$

Position within a rev. : V01 = (28160 MOD 4096) · 16 = 57344 = $E000_H$

b) V12 = -290 DEG, with following configuration :



Number of increments : -290 DEG ➔ $-290 \cdot \frac{2048}{45} = -13198$ INC

Number of revolutions : $V12 = INT\left(\frac{-13198}{4096}\right) = INT(-3.22) = -4 = FFFC_H$

Position within a rev. : V01 = (-13198 MOD 4096) · 16 = 50976 = $C720_H$

Note :

The round of increment causes an error on the position due to the resolution (4096 increments per revolution).
In the example b), 13198.22 INC is rounded at 13198 INC, in this case, the correct position is :

$$13198 \cdot \frac{45}{2048} = 289.995 \text{ DEG} \neq 290 \text{ DEG}$$

2.3 Dialogue protocol for access to blocs

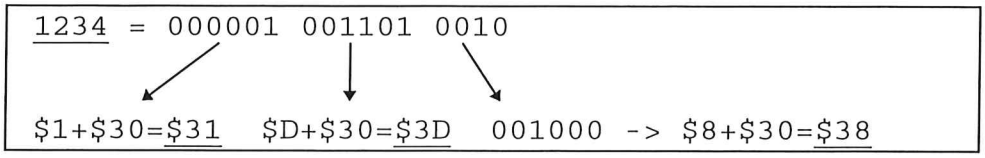
Except for values codification, the protocol principle is the same as describes in « Instruction manual 2000/4000 ».

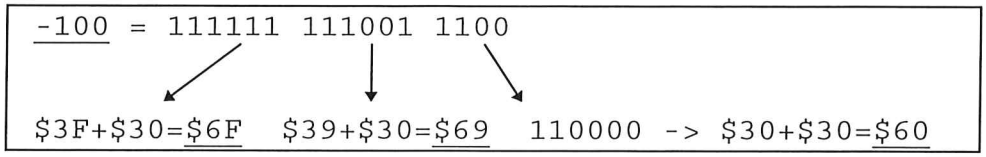
Serial protocol for write bloc :

<STX><AXIS_ADDRESS+48><W><BLOC_ADDR><VALUES CODE><ETX><BCC>

Example : Write in Variable Bloc 0, Axis address 2
V00 = 1234 = $04D2 $ = Hexadecimal
V01 = -100 = $FF9C
V03..V08 = 0 = $0000
Bloc address : 36 (= $24),
Axis address : 2 (+48 = 50 = $32)

Parameter coding 16 bits -> 3 bytes:





Hexadecimal codes for the write :

$02, $32, $57, $24, $31, $3D, $38, $6F, $69, $60, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $03, $12

The drive replies ACK ($06) when the message is correctly received. When checksum is not correct the drive replies nothing.

Serial protocol for read bloc :

<STX><AXIS_ADDRESS+48><R><BLOC_ADDR><ETX><BCC>

Hexadecimal codes for the read of variable bloc 0, axis 2 :

$02, $32, $52, $24, $03, $45

Hexadecimal reply of the drive :
$02, $32, $52, $24, $31, $3D, $38, $6F, $69, $60, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $30, $03, $17

Index

W

These instructions have been written and checked to the best of our knowledge and belief.
However, IRT will not be liable for errors and reserves the right for changes at any time without notice.

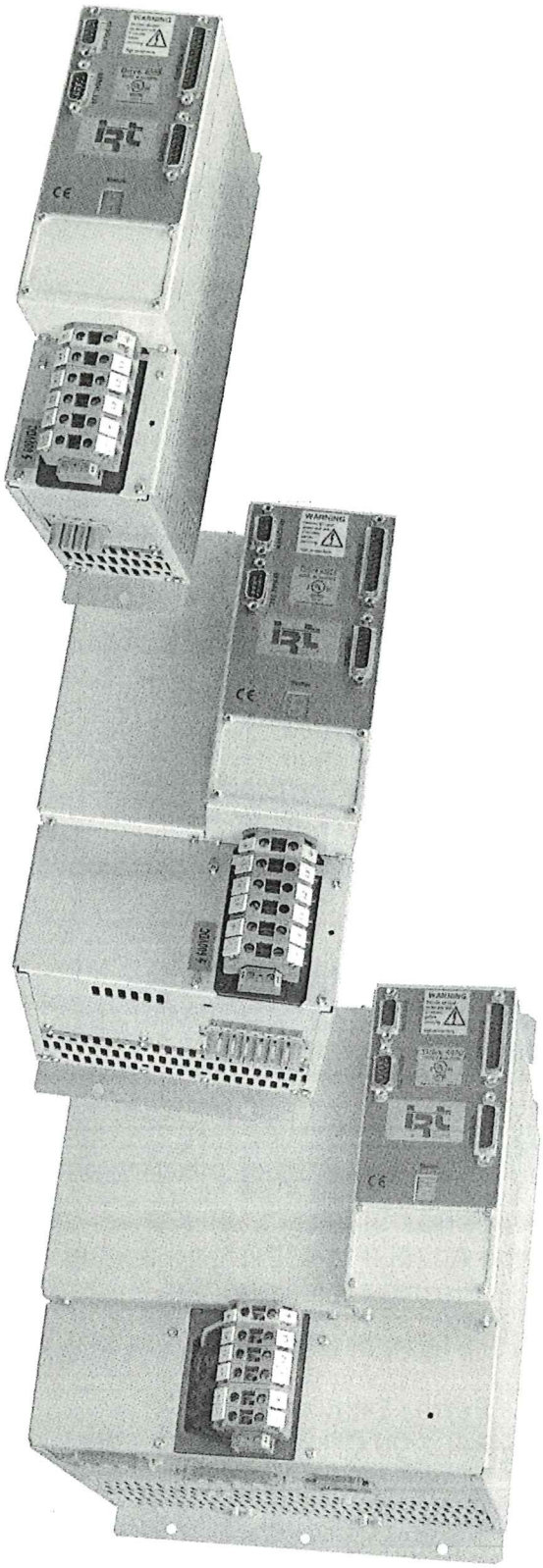
PROFILE, INSTRUCTION MANUAL EVOLUTION

Version March 1999 modifications and news compared with September 1998 manual :

SECTION	PAGE	NEW	MODIF	DESCRIPTION
-	27	X		Appendix A : variable (preliminary) added
3	7	X		Output schema added
3.2	9		X	OUT14, Drive OK : Profile status number corrected.
5.1	25		X	Profile status P-b and P-C effect (end-limit reached) : stop with motor maximal current.

LAST MODIFICATION : 12 MARCH 1999

TECHNICAL MANUAL



DRIVES
4000 S-AT
SMALL

4000 M-AT
MEDIUM

4000 L-AT
LARGE

c UL us
LISTED
E208415

CE

REIS GROUP

IRT SA
Rue du Puits-Godet 16
CH-2000 Neuchâtel

Tel. +41 (0)32 729 93 60
Fax +41 (0)32 724 10 23
e-mail info@irtsa.com
http://www.irtsa.com

Your drive provider

September 2013-Rev. 5

UL Requirements Drives Series 2000 / 4000 AT

1. Field wiring terminal to use 60/75 or 75°C copper (CU) wire only.
2. Input power terminal tightening torque = 1.2 Nm
3. Motor terminal tightening torque = 0.5 Nm
4. No overspeed protection incorporated
5. Degree of overload protection provided internally by the drive, in percent of full load current or current value.
6. Open chassis to be installed in an enclosure that protects the drive from conductive dust and condensation (pollution degree 2 environment).
7. Maximum surrounding air temperature = 40 degree C.
8. These devices are not provided with motor overtemperature sensing.
9. Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
10. Suitable for use on A circuit capable of delivering not more than 5000 rms - symmetrical amperes, 230 (2000 Serie) and 400 (4000 Serie) Volts maximum. The short circuit ampere rating and the fuse ampere rating shall be in accordance with the following rating table :

Drive Model	Branch Fuses	
	Ratings	Reference
4003	30A – 690V (rated I^2t 815)	Ferraz Shawmut, JFHR2 – type A070GRB 30EI13, 10,3 x 38 (reference M330015)
4005		
4009		
2005		
2010		
2020	50A – 690V (rated I^2t 2250)	Ferraz Shawmut, JFHR2 – type 6.900 CP gRC, 14.51 x 50 (reference L220902)
4015		
4025		
4050	100A / 690V (rated I^2t 11950)	Ferraz Shawmut, JFHR2 – type 6.900 CP gRC, 22.58 x 100 (reference W220911)

UL listed drives : 2000 S-AT 4000 S-AT 4000 M-AT 4000 L-AT

Contents

CHAPTER A - DESCRIPTION AND TECHNICAL DATA

1. Introduction

The servo-amplifiers serie 4000 AT are intended for the control of 3 phases brushless servo-motors and asynchronous servo-motors.

The motors regulated by the serie 4000 AT servo-amplifiers should have the following characteristics:

- Rotor constructed with permanent magnets or winding cage arranged in 1, 2, 3, 4, 5 or 6 pole pairs, without commutator.
- Stator constructed with 3 windings connected in star or delta.
- Brushless motors : electronic commutation is performed by means of a feedback type :
  Speed one resolver
  Absolute encoder SinCos Hiperface compatible
  Incremental encoder with U, V and W signals
  EnDat.
- Asynchronous motors : electronic commutation is only performed by means of a feedback type :
  Speed one resolver
  Incremental encoder.
- Motors with Hall effect sensors and tachogenerator are not suitable.

The servo-amplifier serie 4000 AT are fully digital. High-performance torque, speed and positioning control fulfils all requirements for rapid response and control accuracy.

Digital control allows comprehensive diagnostics, motor parameters tuning, data and fault logging, etc.. using a PC based user program.

A wide range of firmware assures to meet the requirements of practically any application.

2. Description

The particular features of the servo-amplifiers serie 4000 AT are described thereunder:

Power supply

- Single-Axis unit incorporating braking module for connection to 3 phases power supply. Possibility to connect the drives to a common DC-bus voltage.
- Direct 400V three-phase main supply.
- Option: Internal filters in power source reducing noise emission.

Power driver

- Galvanic isolation between control and power electronics.
- IGBT output stage.
- Digital PWM current loop providing very low ripple motor currents and high motor efficiency.

Digital controller

- Full-digital servo-amplifier for Brushless motor with resolver.
- Easy software update and fully programmable through serial link RS232 or RS485.
- Possibility to integrate a customised *INTERFACE* board.
- Energy managing system for fan-cooling.
- Multi loops control (torque and speed).
- Sinusoidal current output ensures smooth torque and optimal performance at low speed.
- 7 segment status indicator for diagnostic display.

User's inputs

- Analogue speed or current input command +/- 10V or digital input command.
- RS232 serial port and RS485 serial port for multi axis controller system.
- Limit switches for overrun protection in both directions.
- External power supply to the Control and Interface boards to keep position data and alarms in case of main power supply interruption.

User's outputs

- Incremental encoder output simulation with adjustable resolution from 1 to 1024 ppr and adjustable marker pulse. Differential line driver outputs.
- Ready relay contact.

Protections

- Protection and rugged construction for use in adverse conditions.
- Power stage fully protected against short-circuit and over-temperature.
- Motor protection by I^2t limitation.
- Detection of resolver fault, motor wiring failure, motor overheating.

3. Technical data

3.1 General data for all types

Description		Unit	4000 AT Serie
Supply frequency		Hz	45 to 65
Operating temperature range		° C	0 to 60
Operating temperature range at full power (from 45°C, reduce output current by 2%/°C to 60°C)		° C	0 to 45
Storage temperature range		°C	-25 to +55
PWM chopper frequency		kHz	7.5
Differential input reference		V	+ 10 to -10
Speed control range			1/32768
Speed loop bandwidth		Hz	max. 150
Current loop bandwidth		Hz	max. 2000
Output frequency to motor		Hz	0 to 500
Incremental encoder simulation		ppr	1 to 1024 (2048)
Theoretical max. speed for motor with resolver "speed one"		rpm	7500 or 12000 depending on firmware version
Serial link	Standard baud rate	Bd.	9600
	Transmission		Full duplex
	Format		1 START bit, 8 DATAS bit, no parity, 1 STOP bit
Time between power on and enable drive		sec	Max. 3
International Protection			IP20
Supply Voltage		VAC	3x400 +10% -20%
Max. output voltage to motor		V	3 x 390
ON-Switching threshold of brake module		VDC	670
OFF-Switching threshold of brake module		VDC	660
ON-Trip threshold of overvoltage		VDC	710
OFF-Trip threshold of overvoltage		VDC	690
OFF-Trip threshold of undervoltage		VDC	395
ON-Trip threshold of undervoltage		VDC	380
Cooling			Natural air convection Air fan forced over 40°C
Indicative weight :	Small AT Medium AT Large AT	kg	3.3 6.2 10,5

3.2 Electrical data

Drive AT Type		Rated rms current ($I_{rms\ rated}$) (A)	Rated pk. current ($I_{peak\ rated}$) (A)	Max. rms current ($I_{rms\ max}$) (A)	Max. peak current ($I_{peak\ max}$) (A)	Rated power (P_{rated}) (kW)	Max. power (P_{max}) (kW)
Small	4003	3	4	6	8.5	2	4
	4005	5	7	10	14	3.5	7
	4009	9	13	18	25	6	12
Medium	4015	15	21	30	42	10	20
	4025	25	35	50	70	17	34
Large	4050	50	70	100	140	34	68

Note: $I_{rms} = I_{peak} / 1{,}41$ $V_{rms} = 390V$

$P = 1{,}73 \times I_{rms} \times V_{rms}$ or $P = 3 \times I_{rms/phase} \times V_{rms/phase}$

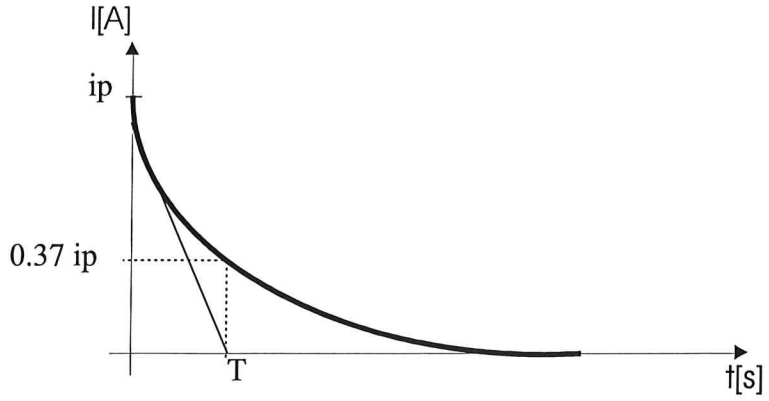
Braking power :

Drive AT type		$R_{braking}$ (Ω)	Peak braking power (kW)	Max. continuous braking power (W)	Surge energy (ΔT=300K) (kJ)
Small	4003	60	7.5	250	5
	4005	60	7.5	250	5
	4009	60	7.5	250	5
Medium	4015	30	15	500	10
	4025	16.5	27	500	15
Large	4050	11	40	1000	22

The surge energy rating is the maximum permitted dynamic brake application from cold. To a first approximation, heat is then removed at the rate given by the continuous power figure : thus about 20 seconds interval must be allowed between full energy stops.

3.2.1 Inrush current

Wave shape for the nominal values



$$i(t) = i_p \cdot e^{-t/T} \qquad \Rightarrow \qquad i^2 \cdot t = \frac{1}{2} \cdot i_p^2 \cdot T$$

Inrush current ip :

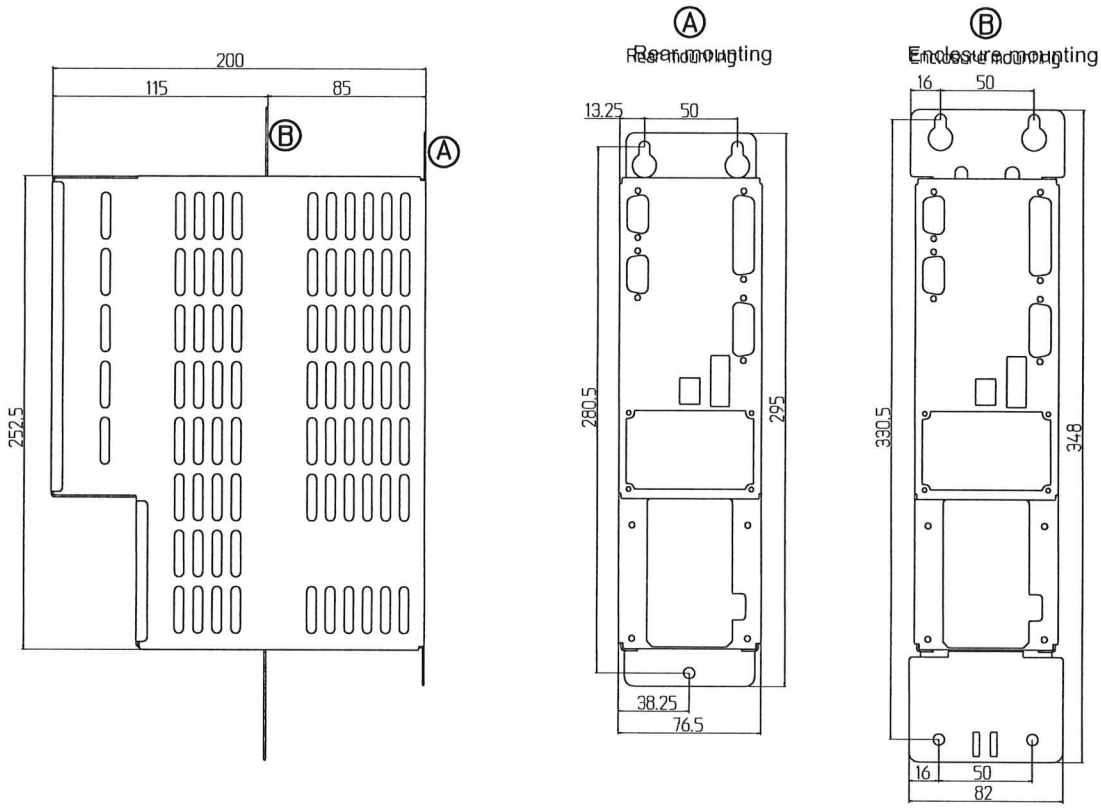
Small 4003, 4005, 4009 AT:
ip = 9.3 A and T = 14 ms ⇒ i^2 t = 0.6 A^2s

Medium 4015 AT: ip = 18.7 A and T = 21 ms ⇒ i^2 t = 3.7 A^2s
Medium 4025 AT: ip = 34 A and T = 11.5 ms ⇒ i^2 t = 6.7 A^2s

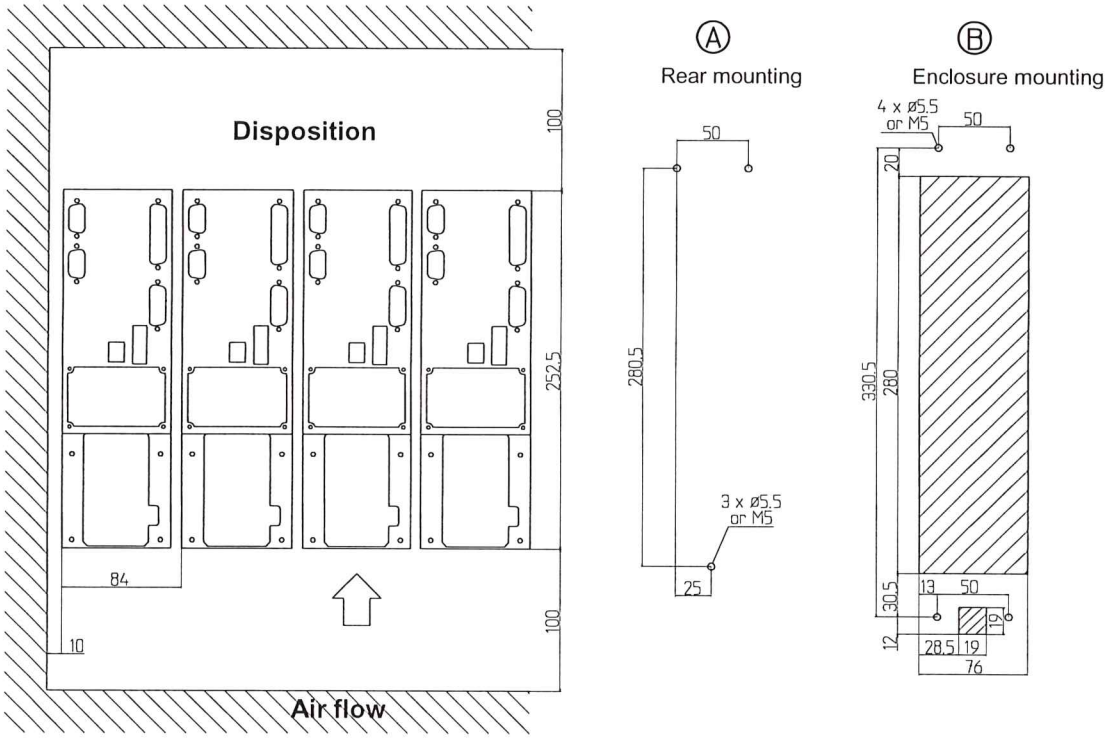
Large 4050 AT: ip = 51 A and T = 10.3 ms ⇒ i^2 t = 13.4 A^2s

3.3 Drives AT outlines

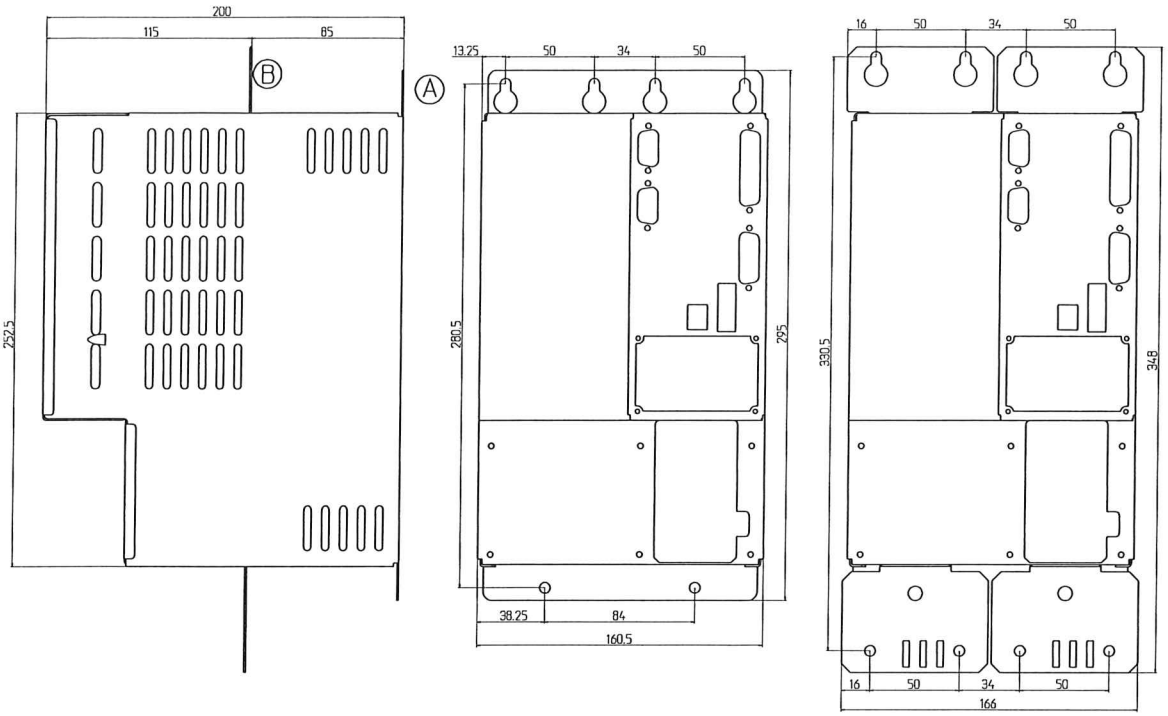
3.3.1 Small AT drive outlines



Installation, drill and cutout plan :



3.3.2 Medium AT drive outlines

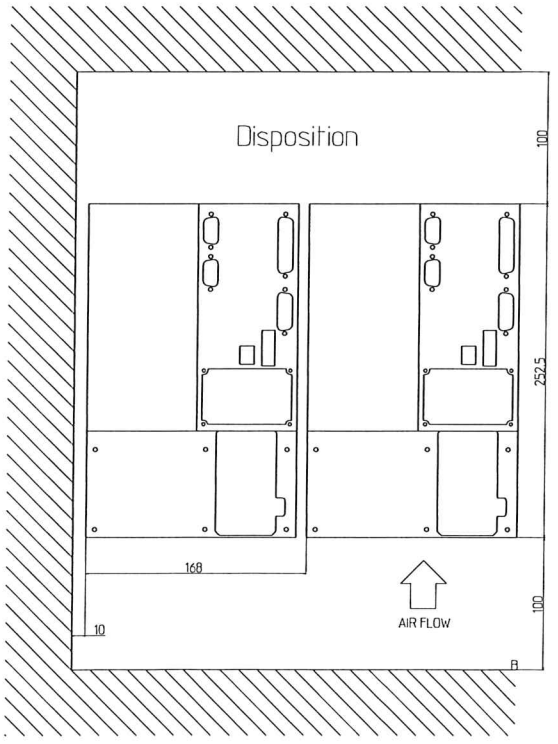


Medium AT mounting

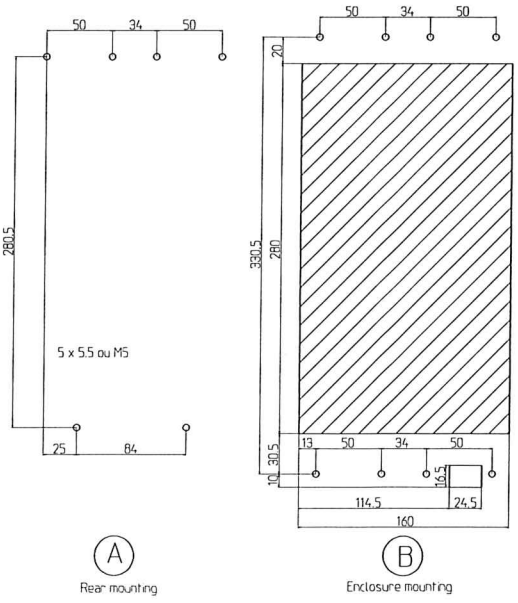
Ⓐ Rear mounting

Ⓑ Enclosure mounting

Installation, drill and cutout plan :



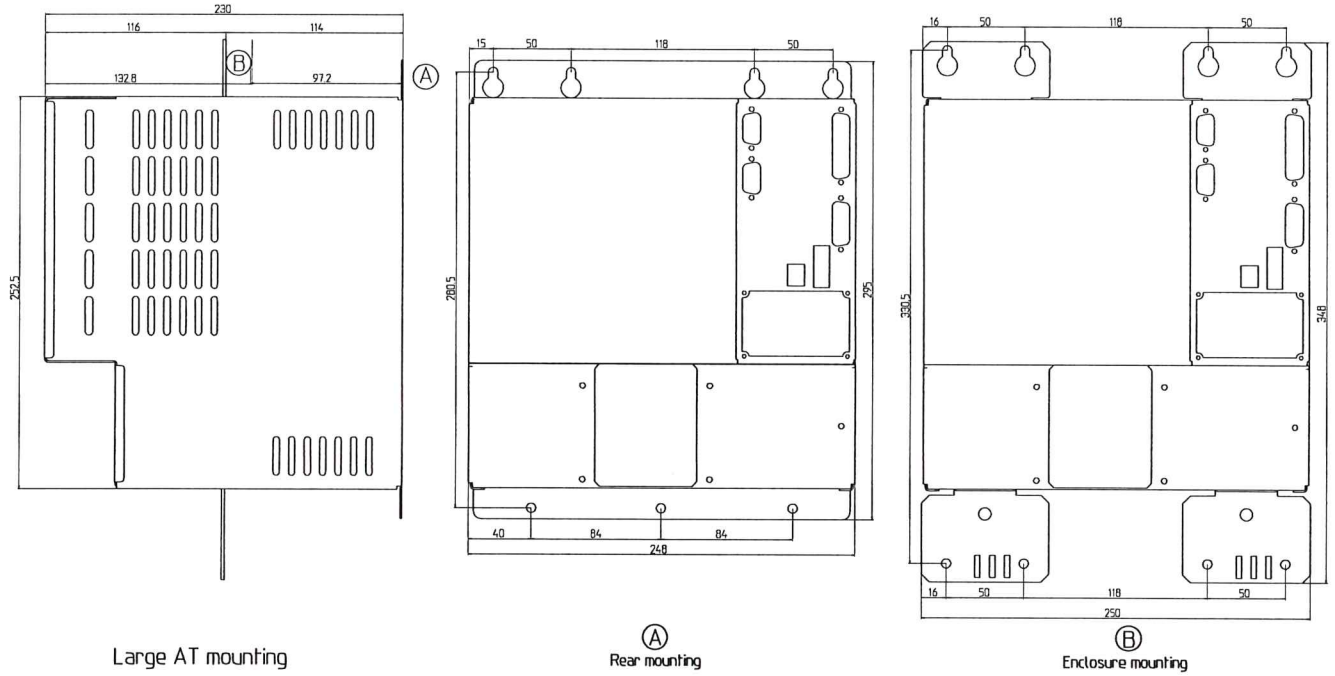
Installation, drill and cutout plan



Ⓐ Rear mounting

Ⓑ Enclosure mounting

3.3.3 Large AT drive outlines

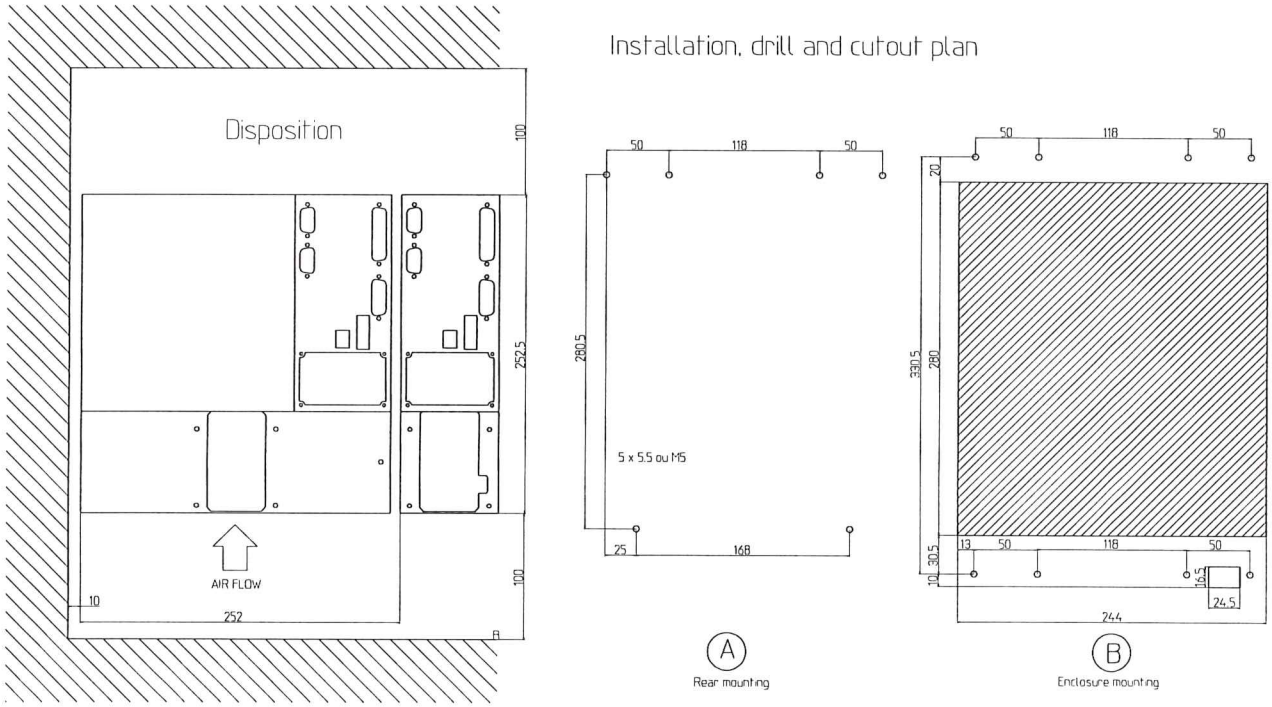


Large AT mounting

Ⓐ Rear mounting

Ⓑ Enclosure mounting

Installation, drill and cutout plan :



Ⓐ Rear mounting

Ⓑ Enclosure mounting

3.4 Motors

- ❑ **Brushless 3 phases servo-motors**
- ❑ **Asynchronous, 3 phases motors**

3.5 Position feedback

- ❑ **Resolver :**

Characteristics :

- Speed One (1 sine period and 1 cosine period per revolution)
- Ratio 0.5 ± 10%
- Reference frequency : 5..10 kHz
- $Z_{RO} > 95\Omega$ @ 7,5 kHz (Input impedance)
- $Z_{SO} < 1000\Omega$ @ 7,5 kHz (Output impedance)

- ❑ **Incremental encoder for asynchronous motor only.**
- ❑ **Absolute encoder Stegmann SinCos Multi and Single turn SRS/M 50/60(HIPERFACE compatible).**
- ❑ **Incremental encoder with U, V and W signals for synchronous motor.**
- ❑ **EnDat encoder.**

4. Fuses

The following fuses are factory equipped in all units of the series 4000 :

Drive Type AT		DC-BUS (FBUS)
Small	**4003 , 4005, 4009**	**30A gRB/690V** 10.3x38 Ferraz, art. A070 gRB 30T13 *UL: E76491* Art. IRT: 2410.159.30
Medium	**4015, 4025**	**50A gRC/690V** 14x51 Ferraz, art. L220902 *UL: E76491* Art. IRT: 2410.160.50
Large	**4050**	**100A URB/690V** 17x49 Ferraz, art. C220986 *UL: E76491* Art. IRT: 2410.163.100

NB : No replacement of any fuse should be carried out until the reason for it's blowing has been rectified.

5. Option list

1. **EMC FILTER ON 3 PHASES INPUT SUPPLY (Small AT only)**
2. **MECHANICAL MOTOR BRAKE RELAY**
3. **RS485 BUS**
4. **AUXILIARY 24V SUPPLY**

6. Add-on boards

Add-on boards compatible with series 2000 Small drives

❑ IRT PROFILE

Add-on board to perform simple movements and interfacing with 24V systems (PLS).

Main characteristics :

- 24 V powered.
- DC-DC conversion for drive power back-up (the position value is kept when main supply of the drive is switched off).
- 14 Outputs potential free (24V 100 mA).
- 16 Inputs 24V potential free.
- Windows Profile User software for easy setting.

To obtain more information about Profile board, contact your IRT distributor.

Distributed by :

Official IRT distributors.

❑ UVW ENCODER FEEDBACK

See Special functions specification.

Distributed by :

Official IRT distributors.

❑ Dual analogic bipolar output

Outputs range : **+/- 10V**

Output SPEED : **1V corresponds to 1000 RPM**

Output CURRENT : **10V corresponds to $I_{MAX\ DRIVE}$**

Distributed by :

Official IRT distributors.

Add-on boards compatible with series 2000 Small drives

❑ MKS IR115 / IR116 / IR117

Synchro-Control, positioning and CANopen interface module for IRT Series 2000 Small drives.

Manufacturer :

MKS Mashinen-Kontroll-System Gmbh
Zwischen den Wegen 32
D-78239 Rielasingen 2 - Germany
Tel. +49 (0)7731-9332-0
Fax +49 (0)7731-9332-30
E-Mail info@mks-sys.com
Internet www.mks-sys.com

Distributed by :

MKS.
Official IRT distributors.

❑ QUIN SERVOnet

Positioning control and SERVOnet (CAN-BUS type) interfacing module for IRT series 2000 Small drives.

Manufacturer :

Quin Systems limited
Oakland business Centre
Oakland Park
Wokingham
Berkshire RG41 2FD
Tel 0118 977 1077
Fax 0118 977 6728
E-Mail : sales@quin.co.uk
Internet : www.quin.co.uk

Distributed by :

Quin System.

DRIVE SERIES 4000 AT, TECHNICAL MANUAL EVOLUTION

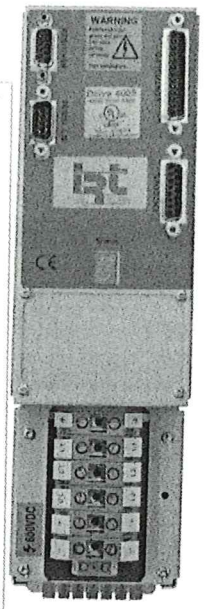
CHAPTER	PAGE (OLD VERSION)	PAGE	REVISION	DESCRIPTION
			2	Manual reduced to Technical manual for drives 4000 AT UL
	1	1	3	Image from Large Drive
3	8	8	3	Braking power new definition
	2	2	4	UL Requirements
3	10	10	4	Drives outlines, Motor + Feedback
	2	2	5	UL Requirements

Last modification : September 2013

REIS GROUP

4000 SMALL

Data



Technical data

Description	Unit	Serie 4000 AT
Supply voltage	VAC	3x400 +10% -20%
Supply frequency	Hz	45 à 65
Environment temperature	°C	0 à 60
Operating temperature at full power (from 45 ° C, reduction of the output current of 2% / ° C to 60 ° C)	°C	0 à 45
Storage temperature	°C	-25 à +55
PWM switching frequency	kHz	7.5
Differential input (setpoint)	V	+10 à -10
Reference range speed		1/32768
Speed loop bandwidth	Hz	max. 150
Current loop bandwidth	Hz	max. 2000
Dissipation capacity during braking with standards resistors	W	250
Motor output maximum voltage	V	3 x 390
Motor output frequency	Hz	0 à 500
Incremental encoder simulation	ppr	1 to 1024
Maximum theoretical speed. motor with resolver "speed one"	RPM	7500
On threshold braking	VDC	670
Threshold braking	VDC	660
On threshold over voltage	VDC	710
Threshold over voltage	VDC	690
Threshold under voltage	VDC	395
On threshold under voltage	VDC	380
Serial transmission	Type	RS232 and/or USB
Degree of protection		IP20
Approximate weight	kg	3,3

Electrical data

Drive type AT	Rated rms current [A]	Rated pk. current [A]	Max. rms current [A]	Max. peak current[A]	Rated power [kW]	Max. power [kW]
4003	3.5	5	7	10	2.5	5
4005	5	7	10	14	3.5	7
4009	9	13	18	25	6	12

Braking power

Drive type AT	R braking [Ohm]	Peak braking power [W]	Max. continuous raking power [W]
4003, 4005, 4009	60	7500	250

Feed back

Compatible with :

- Resolveur
- Encodeur
- Sick-Stegmann Hiperface
- Sick-Stegmann Hiperface DSL
- HEIDENHAIN EnDat

Interface

- Profile
- Ethercat
- Profinet

Compatible with :

- Asynchrone
- Brushless

4000 Series

4000 Small
4000 Medium
4000 Large

2000 Series

2000 Mini
2000 Small
2000 Dual
Low Voltage

Control units for 2000 & 4000 Series

CU 2115

700 Series

700

Support

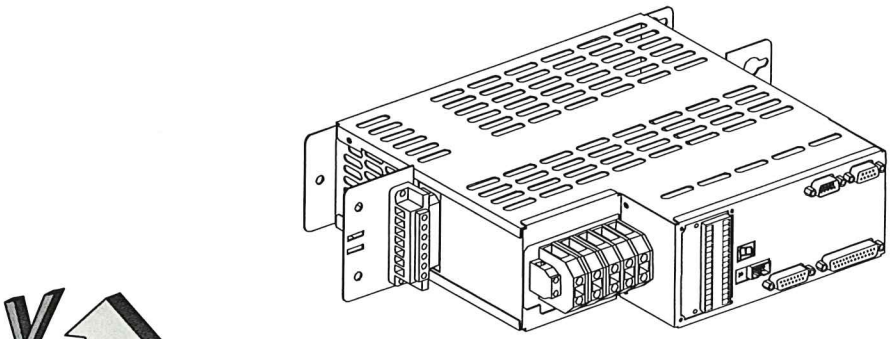
4000 and 2000 Series User 2000/4000 (16 bit)
IDM (32 bit)

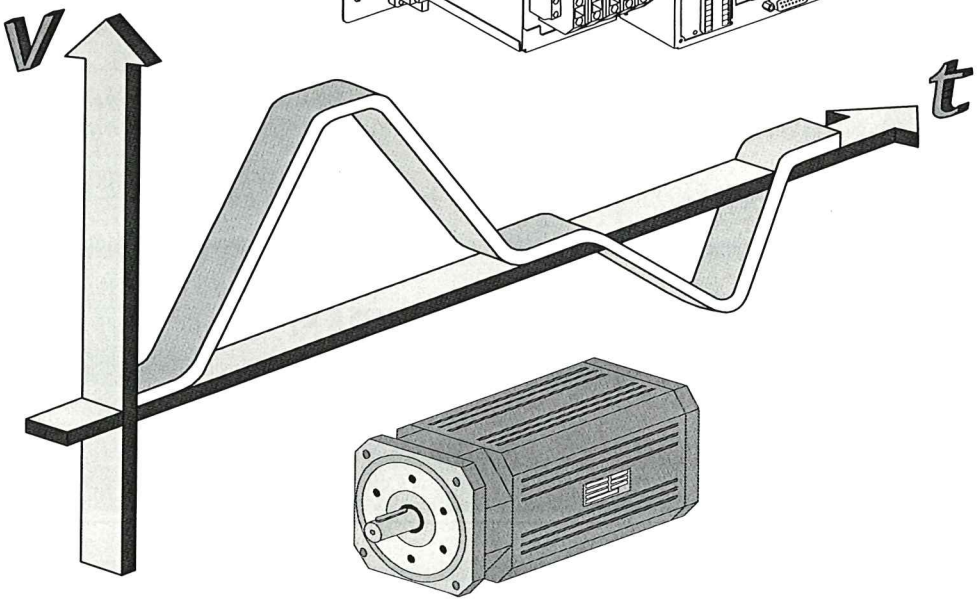
March 1999

INSTRUCTION MANUAL

PROFILE

DRIVE 2000 / 4000





IRT SA
Rue du Puits-Godet 16
CH-2005 Neuchâtel

Tel. +41 (0)32 729 93 60
Fax +41 (0)32 724 10 23
e-mail info@irtsa.com
http://www.irtsa.com

Your drive provider

Contents

1. Overview

The profile package, board and software, allows you to realise elementary movement in combination with inputs and outputs.

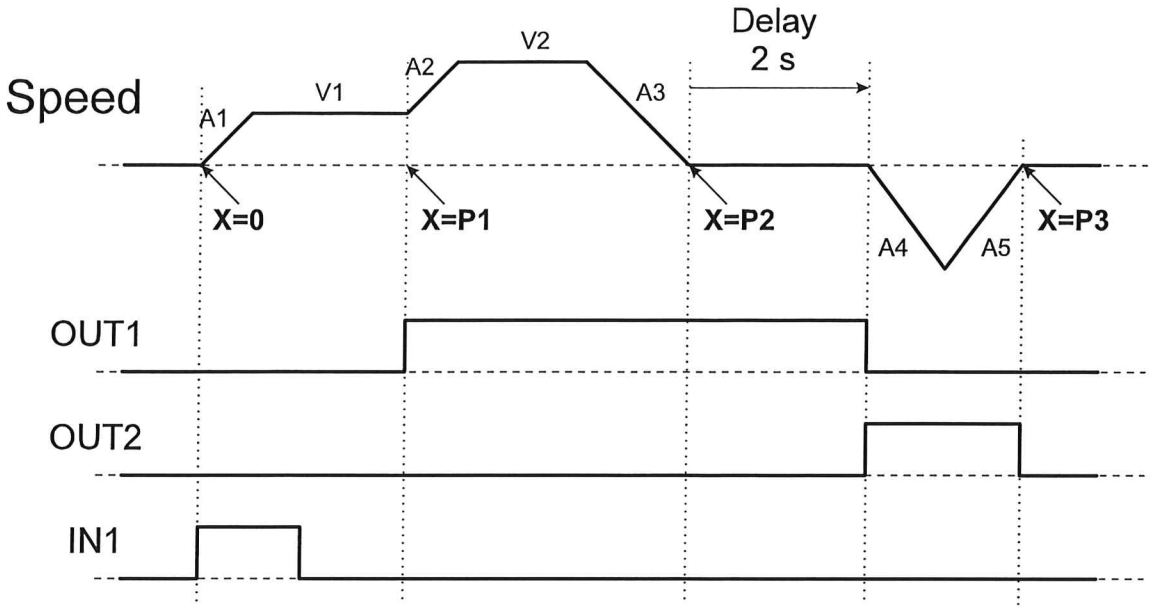
Hardware features :

- Easy plug in a IRT drive of series 2000 and 4000.
- 24 VDC inputs.
- 24 VDC outputs with short circuit protection.
- DC-DC 24V to 6V conversion for drive power backup .

Software features :

- Off-line programation with Windows software (for Windows 3.1 or later).
- Transfer of program direct in the non-volatile memory of the drive by RS232 serial link.
- Input/output functions.
- Time functions.
- Relative and absolute positions commands.
- Jump functions.

1.1 Example of movement



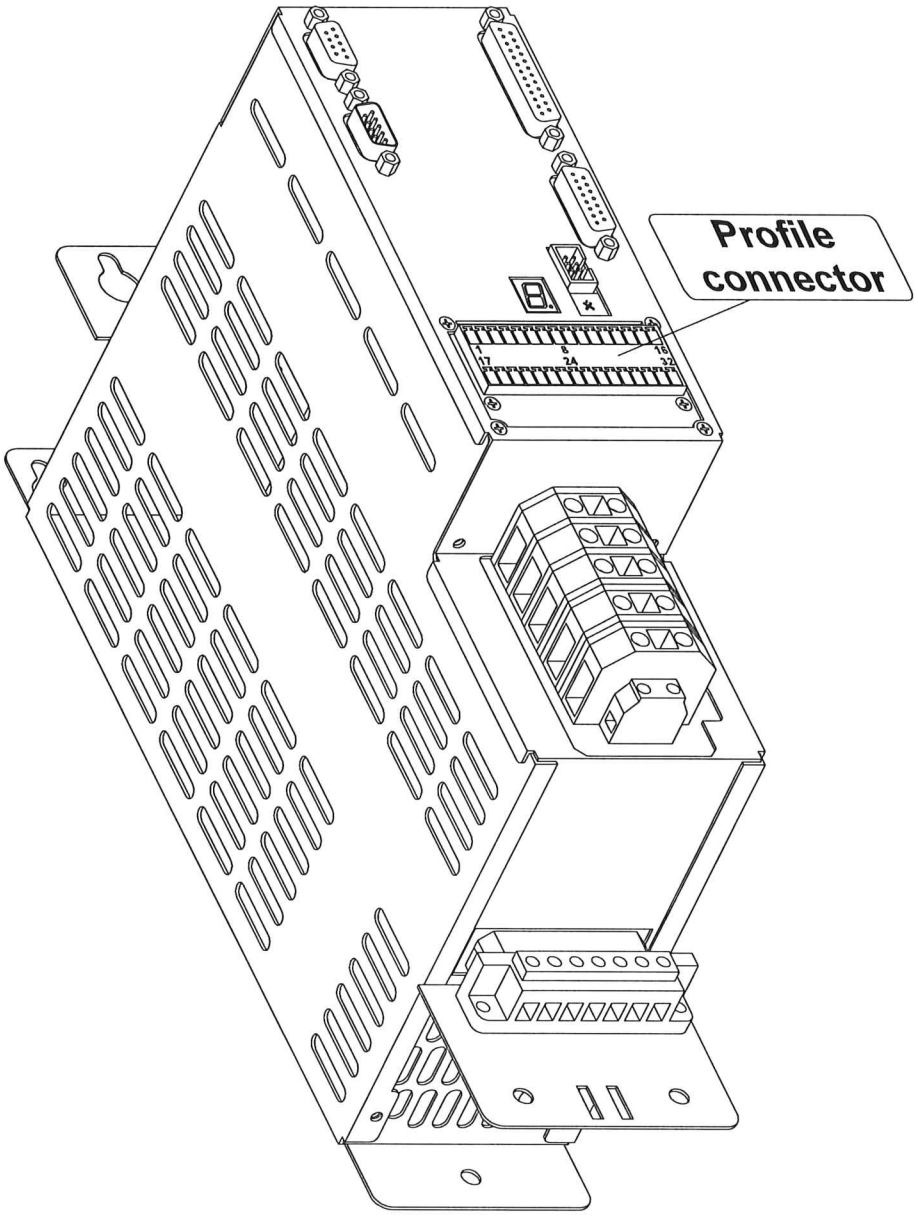
This example is composed of two movements and one delay. The first movement, from x=0 to x = P2 contains a speed change at x=P1. For the second movement, from x=P2 to x=P3, the maximum speed is not reached.

The input IN1 starts the programmed sequential operations.

The output OUT1 is set when x=P1 and cleared 2 seconds after the position x=P2 is reached.

The output OUT2 is set when OUT1 is cleared. OUT2 is cleared when position P3 is reached.

2. Mechanical description



Profile connector type:

Drive part :

MINICONNEC MCDV 1.5/16-G1-3.81 (32 PIN Male)

Opposing part :

2 x MINICONNEC MC 1.5/16-ST-3.81 (2 x 16 PIN Female for wires 0.14 - 1.5 mm^2)

3. Electrical characteristics

SUPPLY :

Supply voltage : U_{supply} = 24 VDC ±25%
(=18..30 VDC)

INPUTS (IN1..IN16):

Input impedance : Z_{IN} = 7,1 kΩ

High level detection : U_{IH} = 16..30 V

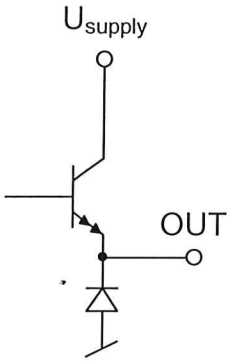
Low level detection : U_{IL} = 0..5 V

OUTPUTS (OUT1..OUT14):

Max. output current : I_{OH} = 100 mA

Output voltage : $U_{OH} = U_{supply} - 1.6$
(@ I_{OH} = 100 mA)

All outputs are short-circuit protected.



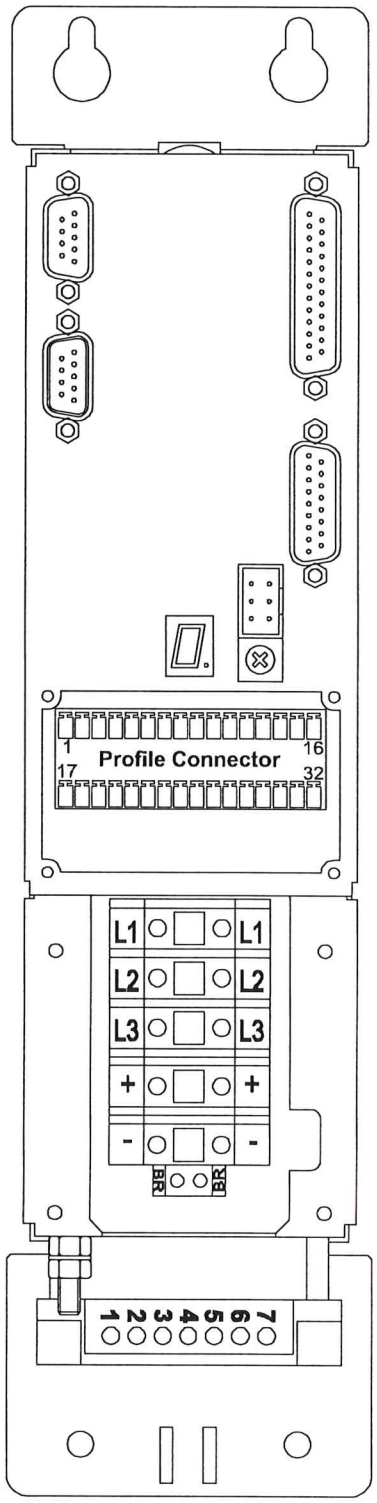
NOTES :

- Inputs and outputs voltage with respect to GND
- The inputs and outputs are fully potential free with the internal voltage (opto-coupler separation).
- The input IN16 is directly hardware wired to the drive **TORQUE ENABLE**.
- When a short-circuit is detected, the output is desactivated and an indication is shown by display (Profile Status P-F). The short-circuit can be reset by the « INIT DRIVE » input or by a serial link « RESET » command.

3.1 Connector pinout

PIN Number	Name	Description
1	OUT1	
2	OUT2	
3	OUT3	
4	OUT4	
5	OUT5	
6	OUT6	
7	OUT7	
8	OUT8	
9	OUT9	
10	OUT10	
11	OUT11	
12	OUT12	Position OK
13	OUT13	Homing ended
14	OUT14	Drive OK
15	**24V**	**Power supply 24 V**
16	**GND**	**Power supply GND**
17	IN1	Profile selection
18	IN2	
19	IN3	
20	IN4	
21	IN5	
22	IN6	Profile validation
23	IN7	
24	IN8	
25	IN9	
26	IN10	
27	IN11	
28	IN12	End-limit +
29	IN13	End-limit -
30	IN14	Stop \
31	IN15	Init drive
32	**IN16**	**Torque enable**

Front view :



3.2 Fixed inputs/outputs functions

Some inputs and outputs are already fixed for specified functions :

FIXED OUTPUTS

OUT12, POSITION OK

Activated when the motor position equals to the pointed position (the positioning window value defines the tolerance for the pointed position).

OUT13, HOMING ENDED

Activated when a homing function is ended. This output is cleared when the drive is initialised or when a new homing is started.

OUT14, DRIVE OK

Indicate when the drive is ready (no drive alarm and torque enable). This following events will disable the **DRIVE OK** output :

- Any drive alarm.
- Torque disable.
- Following error (profile status P-A).
- No profile loaded or CRC check error (profile status P-E).
- Unknow command (profile status P-9).
- No 24V supply or output short-citcuit (profile status P-F).

FIXED INPUTS

IN1-6, PROFILE SELECTION AND VALIDATION

See section 3.3, profile selection.

IN12, END-LIMIT+

Stop the positive speed (active when 24V is applied).
Firmware version 2305 or higher :
If the bit 0 of drive parameter 24 is set, the **END-LIMIT+** input is inverted (active when 0V is applied, see section 5, page 23, description of parameter 24).

IN13, END-LIMIT-

Stop the negative speed (active when 24V is applied).
Firmware version 2305 or higher :
If the bit 1 of drive parameter 24 is set, the **END-LIMIT-** input is inverted (active when 0V is applied, see section 5, page 23, description of parameter 24).

IN14, STOP\

When this input is enabled (24V removed), the motor stops with the « Stop » deceleration (value set by the command « STOPDECEL »). When input is disabled again, the profile execution is recovered (the motor resumes the movement with the defined acceleration).

IN15, INIT DRIVE

Drive initialization, all values are initialized (position, acceleration, speed,..), a profile selection is waited. In addition, this input resets a short-circuit detection

IN16, TORQUE ENABLE

While this input is disabled, the motor is not supplied.

3.3 Profile selection

A program can be composed of 1 to 32 profiles. At power on or after an initialization, a profile selection must be performed to start into the desired profile.

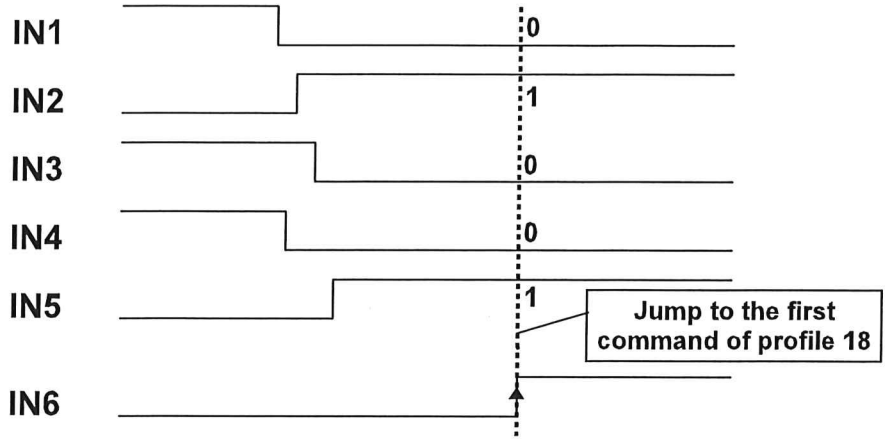
INPUT1 to INTPUT5 are used to select one of the 32 profiles. The table below gives the relation for profile selection :

Profile Nr.	IN5	IN4	IN3	IN2	IN1
0	0	0	0	0	0
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
4	0	0	1	0	0
5	0	0	1	0	1
6	0	0	1	1	0
7	0	0	1	1	1
8	0	1	0	0	0
9	0	1	0	0	1
10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1

Profile Nr.	IN5	IN4	IN3	IN2	IN1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0
21	1	0	1	0	1
22	1	0	1	1	0
23	1	0	1	1	1
24	1	1	0	0	0
25	1	1	0	0	1
26	1	1	0	1	0
27	1	1	0	1	1
28	1	1	1	0	0
29	1	1	1	0	1
30	1	1	1	1	0
31	1	1	1	1	1

Profile validation (INPUT6) :
INPUT6 enables the start in a profile after power on or after the END of a profile.

The profile is selected at the positive edge on INPUT6.
Example for selection of profile number 18 :



If the selected profile is empty or not defined in software, no jump is performed and a new valid profile selection is waited.
When a profile is running, a new profile selection is possible only after an END command or after an initialization (only one profile can run).

4. Software

4.1 Command list description

New functions available only with firmware version 2305 or higher :
***(indication* V2305➔ in the table)**

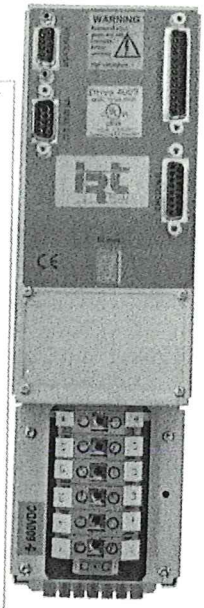
CHKPOS CHKPOSREL IFPOSGEJMP IFPOSLTJMP
IFFALSJUMP STOPMOVE AUTOSTART

COMMAND NAME	DESCRIPTION	EXAMPLE	
SETACCEL	Set the acceleration value in RPM/s	SETACCEL	10000
SETDECEL	Set the deceleration value in RPM/s	SETDECEL	12000
STOPDECEL	Set the stopping deceleration, value for deceleration when stop input is activated	STOPDECEL	20000
SETWINPOS	Set the size of the positioning window in increment.	SETWINPOS	2
SETMAXSPD	Set the maximum speed value in RPM	SETMAXSPD	1500
SETPOS	Set the position counter to a value.	SETPOS	0 REV
SETPOSREL	Shift the position counter with a value.	SETPOSREL	-10 REV
MOVETOPOS	Set an absolute movement, the position set is not waited.	MOVEPOS	23.5 REV
MOVPOSREL	Set a relative movement, the position set is not waited (be careful, the position is relative to the position to reach).	MOVEPOSREL	30.325 REV
WAITPOS	Wait an absolute position.	WAITPOS	0.025 REV
WAITPOSREL	Wait a relative position (be careful, the position is relative to the position to reach).	WAITPOSREL	-5.5 REV
CHKPOS **(V2305➔)**	Check the position. The real position is compared to the given position value.	CHKPOS	20.00 REV
CHKPOSREL **(V2305➔)**	Check the relative position. The real position is compared to the given relative position value(be careful, the position is relative to the position to reach).	CHKPOSREL	-100.0 REV
IFPOSGEJMP **(V2305➔)**	At the last check position command (CHKPOS or CHKPOSREL), if the real position was greater than or equal to the check position then jump to label name.	IFPOSGEJMP	LABEL0

REIS GROUP

4000 SMALL

Data



Technical data

Description	Unit	Serie 4000 AT
Supply voltage	VAC	3x400 +10% -20%
Supply frequency	Hz	45 à 65
Environment temperature	°C	0 à 60
Operating temperature at full power (from 45 ° C, reduction of the output current of 2% / ° C to 60 ° C)	°C	0 à 45
Storage temperature	°C	-25 à +55
PWM switching frequency	kHz	7.5
Differential input (setpoint)	V	+10 à -10
Reference range speed		1/32768
Speed loop bandwidth	Hz	max. 150
Current loop bandwidth	Hz	max. 2000
Dissipation capacity during braking with standards resistors	W	250
Motor output maximum voltage	V	3 x 390
Motor output frequency	Hz	0 à 500
Incremental encoder simulation	ppr	1 to 1024
Maximum theoretical speed. motor with resolver "speed one"	RPM	7500
On threshold braking	VDC	670
Threshold braking	VDC	660
On threshold over voltage	VDC	710
Threshold over voltage	VDC	690
Threshold under voltage	VDC	395
On threshold under voltage	VDC	380
Serial transmission	Type	RS232 and/or USB
Degree of protection		IP20
Approximate weight	kg	3,3

Electrical data

Drive type AT	Rated rms current [A]	Rated pk. current [A]	Max. rms current [A]	Max. peak current[A]	Rated power [kW]	Max. power [kW]
4003	3.5	5	7	10	2.5	5
4005	5	7	10	14	3.5	7
4009	9	13	18	25	6	12

Braking power

Drive type AT	R braking [Ohm]	Peak braking power [W]	Max. continuous raking power [W]
4003, 4005, 4009	60	7500	250

Feed back

Compatible with :

- Resolveur
- Encodeur
- Sick-Stegmann Hiperface
- Sick-Stegmann Hiperface DSL
- HEIDENHAIN EnDat

Interface

- Profile
- Ethercat
- Profinet

Compatible with :

- Asynchrone
- Brushless

4000 Series

4000 Small
4000 Medium
4000 Large

2000 Series

2000 Mini
2000 Small
2000 Dual
Low Voltage

Control units for 2000 & 4000 Series

CU 2115

700 Series

700

Support

4000 and 2000 Series User 2000/4000 (16 bit)
IDM (32 bit)